Southern Alberta Landscapes

MEETING THE CHALLENGES AHEAD ▶▶

Ecological Range Sites and Reference Plant Communities of Southern Alberta, Derived from AGRASID 3.0

Prepared for
Alberta Sustainable Resource Development
By Ron McNeil, LandWise Inc.
Lethbridge, Alberta

March 2003

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ABSTRACT

LandWise Inc. was contracted by the Integrated Resource Management Branch of Alberta Environment to assist in developing a method to extend known ecological range sites and associated plant community information from individual locations to the entire southern Alberta region.

The study area encompasses all of southern Alberta except the Rocky Mountain Natural Region, which includes the Montane, Sub-Alpine and Alpine Natural Subregions. The study area includes the Dry Mixed Grass, Mixed Grass, Foothills Fescue, Northern Fescue, Foothills Parkland and Aspen Parkland Natural Subregions. These natural subregions correspond to Soil Correlation Areas (SCAs) 1, 2, 3, 4, 5, 6, 8 and 9 in the Agriculture Region of Alberta Soil Information Database (AGRASID).

A map showing the aerial extent of each range site was prepared by developing rules to link ecological range sites and their associated major plant communities to soil and landscape information in AGRASID. Integrated Regional Services, Resource Information Unit Staff in Lethbridge used the rules to develop an automated system to create an ArcView-based GIS map linking SLMs to ecological range sites and plant communities.

An initial list of ecological range sites and corresponding plant communities was provided by the Alberta Public Lands Division for each SCA. Definitions for some ecological range sites were modified, and ecological range sites that occur in additional SCAs were identified. Plant communities in some of the additional ecological range sites require future characterization. Rules for linking ecological range sites and corresponding plant communities to the 13,371 AGRASID polygons in the study area were initially based on several AGRASID categories, including parent material, drainage, regional soil choice, landscape models, and soil series. Soil series was found to be the most useful AGRASID category for linking most SLMs to ecological range sites. All soil series present in each SCA are used in the rules for that SCA, and additional categories are used as necessary to supplement the soil series information. AGRASID land systems, the provincial digital elevation model, and the Alberta Vegetation Inventory were also used for some rules. For SLMs with co-dominant soils, the soil series that is most limiting to range production is associated with the corresponding ecological range site and plant community. Rules were initially developed for a pilot area (SCAs 5 and 6), using several steps.

Following the development of an initial manual list, 9.0% of SLMs were flagged because rules did not exist or were incomplete. When the initial rules were first run through a developed computer process for the pilot area, 4.3% of SLMs were unclassified. Nine SLMs (0.7%) were questioned following the next computer iteration. The nine SLMs rarely occur, and in most cases the problems related to the original AGRASID code identification. These errors were corrected by manually manipulating the rules for these few SLMs.

Minor additional rule refinements were conducted when the program was run for the entire study area. Several SLMs that have been incorrectly coded in AGRASID were identified during this project. The GIS map product is the first attempt to identify the link between AGRASID 3.0 and ecological range sites and plant communities. The map product provides a general overview of ecological range sites and plant communities, and therefore it is not recommended for use on a site-specific basis. Plant communities require additional sampling at some locations.

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INTRODUCTION

Alberta Sustainable Resource Development staff (Rangeland Management Branch Public Lands Division and Resource Information Unit, Integrated Regional Services) categorized native range into "range sites" based on recognizable soil and landscape features. Range sites are characterized by unique sets of plant communities, which have been identified for many range sites in southern Alberta. Range sites and plant communities have generally been identified on a pasture – by – pasture basis at many locations in southern Alberta. A method was needed to extend the range site information from individual locations to a larger area of southern Alberta. Estimates of the total area of each range site and plant community in each natural subregion were also needed, to enhance the development of management strategies, to assess information gaps, and to develop a plan for the protection of endangered habitats. The identified plant community is considered the reference plant community, or the major association of plants that would exist when the range is in good to excellent condition.

An improved system for determining range sites is needed to support a new set of range health tools for use by range resource managers, ranchers, and for a wide variety of other groups and users that share an interest in healthy rangelands. We use the term range health to mean the ability of rangeland to perform key ecological functions. These functions include:

- net primary production,
- maintenance of soil/site stability,
- capture and beneficial release of water,
- nutrient and energy cycling, and,
- plant species functional diversity.

Healthy rangelands will provide sustainable grazing opportunities for livestock producers, and will sustain a long list of other products and values. Declines in range health will alert the range manager to the need for management changes. Accurate range site characterization is the first step in selecting the appropriate plant community standard for evaluation.

LandWise Inc. was contracted by the Integrated Resource Management Branch of Alberta Environment in October 2002, to assist in developing a method to extend the known range site and plant community information to all of southern Alberta except the Rocky Mountain Natural Region, including the Montane, Sub-Alpine and Alpine Natural Subregions. A map showing the aerial extent of each ecological range site was prepared by linking ecological range sites and their associated reference plant communities to soil and landscape information in the Agriculture Region of Alberta Soil Information Database (AGRASID) (ASIC 2001). The resulting Geographic Information System (GIS) database was summarized so that the total area of each ecological range site and potential plant community within each SCA could be determined.

The study area encompasses all of southern Alberta except the Rocky Mountain Natural Region, which includes the Montane, Sub-Alpine and Alpine Natural Subregions. The study area includes the Dry Mixed Grass, Mixed Grass, Foothills Fescue, Northern Fescue, Foothills Parkland and Aspen Parkland Natural Subregions. These natural subregions correspond to Soil Correlation Areas (SCAs) 1, 2, 3, 4, 5, 6, 8 and 9 in the Agriculture Region of Alberta Soil Information Database (AGRASID). The study area is bounded by the Saskatchewan border on the east, the Montana border on the south, the Montane Natural Subregion on the west, and the Central Parkland Natural Subregion on the north. The most northerly extent of the study area is Township 42, and the most westerly extent is Range 6-W5. The study area encompasses AGRASID Soil Correlation Areas (SCAs) 1, 2, 3, 4, 5, 6, 8 and 9. The AGRASID SCAs correspond closely to the Natural Subregions (Alberta Environmental Protection 1994) identified by Alberta Environment, including Dry Mixed Grass, Mixed Grass, Foothills Fescue, Northern Fescue, Foothills Parkland and Aspen Parkland.

LandWise Inc., in conjunction with Alberta Sustainable Resource Development staff, developed and documented a detailed set of rules linking AGRASID Soil Landscape Models (SLMs) to ecological range sites and their associated reference plant communities within each SCA. Computer processing was initially conducted in a pilot area, the Foothills Fescue Natural Subregion, so that potential problems could be identified and resolved before conducting the exercise for the entire Southern Region. **The current report documents the methodology for rule development for the pilot area and the complete study area.**

Alberta Sustainable Resource Development (ASRD) staff used the rules documented in this report to develop a computer model to generate geographic information system (GIS) maps directly linking ecological range sites and their associated reference plant communities to AGRASID Soil Landscape Models (SLMs). The results of the ecolgical/range site mapping exercise will ultimately be rolled up into a larger initiative called the A Landscape Cumulative Effects Simulator (ALCES). ALCES was previously created by *Forem Technologies, Bragg Creek, AB and* a team of government and industry to portray the historic and present cumulative effects of anthropogenic activities on the physical environment, and to predict future effects. The intent is to increase the detail of the native prairie vegetation inventory data set based on the described methodology included in this document. This increased detail will assist in improving the outcomes of the modeling & landuse interactions.

As part of the current project, LandWise Inc. assisted Alberta Sustainable Resource Development staff in the use and application of AGRASID 3.0. LandWise Inc. also assisted with refining and enhancing AGRASID information using the Alberta Vegetation Inventory (AVI) and the provincial Digital Elevation Model.

BACKGROUND

Definitions

Ecological Range Sites

Fifteen range sites were originally defined for Alberta (Smoliak et.al 1966). "Range site names are based on easily-recognized permanent physical features such as the kind of soil, climate, and topography, or combinations of these features...and are recognized in the... potential vegetation" (Wroe et al. 1988). Range sites are associated with recognizable plant communities, and they are an important tool used by agrologists and ranchers to optimize the use of range lands.

Range health (Adams et al. 2002) is measured by comparing the functioning of ecological processes on an area of rangeland to a standard known as an ecological site description. An ecological range site is similar to the historical range site concept, but a broader list of characteristics are described. An ecological range site is defined by the Task Group on Unity and Concepts (1995), "is a distinctive kind of land in its ability to produce a distinctive kind and amount of vegetation".

Plant Communities

Each range site within each natural subregion is usually associated with one plant community, although ecological range sites are occasionally associated with up to four plant communities. Plant communities have not yet been characterized for some range sites. Each plant community is characterized by approximately 10 to 15 major plant species, including their range, mean and constancy (percentage of occurrences). Each plant community is characterized by its own production and grazing variables.

The reference plant community associated with each ecological range site is based on site expression of potential natural community, or the association of plants that would exist when the range is in good to excellent condition. In reality, range plant communities may exist at lower seral stages of plant succession, previously termed fair and poor condition, now termed unhealthy or healthy with problems. Lower seral stages are due mainly to alteration by grazing, with a resulting dominance of more grazing-resistant species.

Natural Regions and/or Subregions

"Natural Regions and Subregions" are used by Alberta Environment to subdivide Alberta into ecosystems based on broad features of the landscape, vegetation, soil and physiography, reflecting climate, geology, and soil. Each natural region has unique issues related to conservation and biodiversity (Achuff 1994). Subregions are based on recurring landscape patterns relative to other parts of the natural region.

AGRASID

AGRASID (The Agricultural Region of Alberta Soil Inventory Database) is a standardized digital information database of soils and landscapes for the agricultural region of Alberta (ASIC 2001). AGRASID mapping is based on Soil Correlation Areas

(SCAs). Each of the 24 SCAs reflects a particular soil climate and landscape ecology. SCA boundaries correspond closely to provincial natural subregions (McNeil et al. 2002).

Soil Landscape Models

The basic soil map unit of AGRASID is the Soil Landscape Model (SLM). Soil landscape models are mapped at a scale of 1:100,000 in AGRASID (ASIC 2001). SLMs are characterized by a recognizable landform and topographic relief, with descriptions including soil subgroup, texture and parent material. Each SLM is characterized by a specific "soil series" or multiple soil series, and a specific "landscape model".

Soil Series. Soil series are defined on the basis of detailed features of the soil pedon, such as colour, lithology, texture, and structure. Soil series reflect a unique combination of a soil subgroup and parent material that is present over a representable land area. Soil series are named for geographic points (e.g. towns) located in the area where they occur, and each soil series is denoted with a three-letter symbol.

Many AGRASID Soil Landscape Models (SLMs) are defined by two or three codominant soil series that are present in approximately the same proportions. These SLMs are indicated by four-letter codes, with the first two letters indicating the first codominant soil and the last two letters indicating the second codominant soil. For example, ROSI indicates an SLM with co-dominant Solonetzic Chernozemic (ROL or Ronalaine) and Solodized Solonetzic (SIL or Steveville) soils.

A soil model number between 1 and 21 is included following the soil series symbol. Soil model numbers generally indicate a significant component (10 to 30%) of a particular soil or soils.

Landscape Models. Landscape models reflect landform, surface shape, slope and relief. Landscape models are usually denoted with a capital letter followed by a number followed by a small letter. For a complete listing of landscape models, soil model unit numbers, and soil series, please refer to AGRASID Version 3.0 (ASIC 2001).

Two examples of SLM codes.

- a simple SLM with one dominant soil (ROL) is indicated as ROL1/U11. The soil model number 1 indicates a relatively pure unit with no significant identified soils. The landscape model U11 indicates a low-relief undulating landscape with slopes generally less than 2%.
- a complex SLM with two co-dominant soils (ROL and SIL) is indicated as ROSI2/H11. The soil model number 2 indicates a significant proportion of wet soils (Gleysols or gleyed subgroups). The landscape model H11 indicates low relief hummocky topography (slope classes 3 to 4, slopes of 2 to 9%).

Previous Related Work

LandWise Inc. (1998, 2001) linked range sites (Wroe et al. 1988) directly to soil series based on the soil classification, texture, parent material, drainage, or other characteristics of the soil series, for SCAs 1 to 10, and 16 in southern and central Alberta. An example covering all soil series in SCA5 is provided in Appendix A. The range sites were also linked to applicable landscape models, and to the soil textural triangle adapted from ECSS 1983 (Fig. 1). This information was not directly linked to the basic mapped unit of AGRASID, the Soil Landscape Model (SLM). Because the range sites were linked only to soil series and only included basic landscape information, use and application of the linkages on anything more than a site-specific basis requires an extensive working knowledge of soil variability and soil mapping.

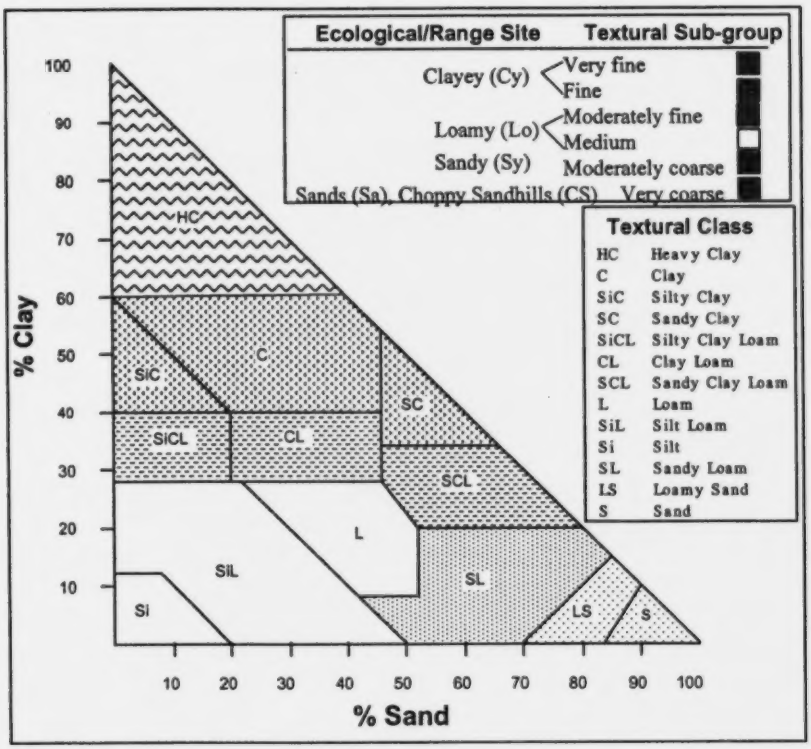

Fig. 1. Ecological range sites that are classified using the soil textural triangle. (Adapted from ECSS 1983).

In addition to the linkages with soil series, LandWise Inc. manually identified: 1) the 594 unique SLMs that directly link to the range sites within a subset area of roughly 108 townships in SCAs 1 and 2 (LandWise Inc. 1998), and 2) the 452 SLMs that link to the range sites within a subset area of 100 townships in SCAs 4, 7, 9 and 10 (LandWise Inc. 2001). The purpose of the manual linkages between SLMs and range sites was to provide Public Lands Agrologists with a tool that would assist them in the use and application of AGRASID, and to improve their conceptualization of how range sites correlate to soils and landscapes. An example set of 15 SLM's from the 1046 SLMs that were manually characterized by LandWise Inc. (1998, 2001) is provided in Table 1. SLMs with a dominant soil series were linked to the associated Range site; SLMs with co-dominant soil series were linked to the two associated Range sites. SLMs with the same dominant or co-dominant soils but different significant soils (identified by the number following the soil series) were generally linked to the same Range site, because significant soils did not usually change the reference plant community.

Table 1. Examples of manual linkages between Soil Landscape Models and Range Sites (From LandWise Inc. 1998, 2001).

SCA	AGRASID SLM	Range Site(s)
1	FMT4/H1l	Lo
1	GEHU13/U1h	BlO
1	GLS1/L2n	SL
1	PHSI4/R2m	TB; BlO
1	SPS15/L1	Cy
4	ERWW1/D1m	CS
4	FSHN4/H1l	Lo
4	HCH1/D1m	CS
4	HCH1/U1h	Sa
9	CYG8/U1h	Lo
9	CYG9/H1m	Lo
9	CYTW1/H1l	Lo; Sy
9	CYTW2/H1m	Lo; Sy
9	CYTW1/H1l	Lo; Sy
9	CYTW2/H1m	Lo; Sy

METHODS

Range Sites and Plant Communities were initially linked to AGRASID soil and landscape information for a pilot area, so that so that potential problems could be identified and resolved before conducting the exercise for the entire study area. The pilot area encompassed the Foothills Fescue Natural Subregion (SCAs 5 and 6).

Alberta Public Lands (APL) staff provided an initial list of the reference plant communities (two to four key range species) for ecological range sites within each

Natural Subregion. The original list was based on descriptions of detailed plant communities from sampled locations (Alberta Rangeland Health Task Group 1999). For example, FFA02 in the Foothills Fescue South Natural Subregion (SCA5) is a loamy ecological range site dominated by Foothills Rough Fescue, Bluebunch Fescue and Sedge.

LandWise Inc. and Alberta Public Lands then identified additional ecological range sites that occur over a significant area of each Natural Subregion, based on a combined working knowledge of plant communities, soils and landscapes in each area. For example, Sands and Choppy Sandhills ecological range sites occur in the Foothills Fescue North Natural Subregion (SCA6), but their plant communities have not yet been characterized by APL staff. For locations with a small sample size, APL staff inserted a preliminary plant community based on sample information collected to date. For ecological range sites that have not yet been sampled, the plant community was flagged as "to be determined". Plant communities at these ecological range sites will be identified and described beginning in 2003.

Rules for linking ecological range sites and plant communities to the 13,371 AGRASID polygons in the study area were developed in an iterative computer process, consisting of an executed series of database query statements and field calculations in ArcView. LandWise Inc. initially prepared a manual list linking ecological range sites and potential plant communities to the 1243 AGRASID polygons in the pilot area (SCAs 5 and 6). The list identified the ecological range sites that were most limiting in terms of range productivity. This manual comparison served to identify gaps in the rules prior to the first run of the iterative process. For the first draft, rules were developed that would apply to as many SLMs within the pilot area as possible. The computer process was run by Alberta Sustainable Resource Development (ASRD), to produce a table listing each SLM with its corresponding ecological range site and plant community.

The results of the initial computer process were used to identify unclassified SLMs, and inconsistencies or errors in the links to ecological range sites and plant communities. Maps derived from the results of the computer process were also examined and compared to AGRASID map products, and to previously published soil survey maps for the entire southern Alberta region. Rules were then modified to correct errors and inconsistencies, and the updated rules were provided to ASRD for subsequent process runs. For the initial SCAs at least four drafts were required to remove all inconsistencies from the results. Rules for later SCAs required about two drafts.

RESULTS

Links Between AGRASID, Reference Plant Communities and Ecological Range Sites

Reference Plant Communities

The boundaries of natural regions/subregions correspond closely to the boundaries of SCAs and soil zones. Each natural region/subregion was assigned a master plant community code during the current project (Table 2). The first two letters of the plant-community code indicate the Natural Subregion. The third letter "A" denotes herbaceous plant communities dominated by graminoids, and described by Alberta Public Lands.

Table 2. Correlation between natural regions/subregions, SCAs and soil zones.

Plant Community Code	Natural Region or Subregion	Soil Correlation Area (SCA)	Soil Zone
DMA	Dry Mixed Grass	1	Brown
MGA	Mixed Grass Highlands	2	Dark Brown
MGA	Mixed Grass	3	Dark Brown
NFA	Northern Fescue	4	Dark Brown
FFA	Foothills Fescue (South)	5	Black
FFA	Foothills Fescue (North)	6	Black
FPA	Foothills Parkland	8	Thick Black
---------	Aspen Parkland	9	Thick Black

Ecological Range Sites

Fifteen of the eighteen ecological range sites listed in Table 3 were originally defined for Alberta by Wroe et al. (1988). The Water, Urban and Riparian ecological range sites were added for the current project. Water and Urban do not meet the technical definition of ecological range sites, but they occupy area, and were identified for this project. The eighteen range site types are now termed ecological range sites (Barry Adams, pers. comm. 2003[1]). The original list (Wroe et al. 1988) included two other range sites (Savannah and Saline Upland), which rarely occur in Alberta. Some of the original range site definitions provided by Wroe et al. (1988) were directly compatible with AGRASID definitions. For example, Choppy Sandhills was originally defined as "Deep, loose, fine sands; surface very irregular, with no profile development (sand dunes)" (Wroe et al.

[1] Barry Adams, Range Management Specialist, Alberta Public Lands, Lethbridge, Alberta.

1988). Within AGRASID, Choppy Sandhills directly correlates to very-coarse-textured soils (loamy sand and sand) on duned landscape models, and the soils are typically Regosolic or Rego Chernozemic, both of which lack a B horizon, consistent with "no profile development".

Table 3. Ecological range sites, with definitions[Z] and abbreviated AGRASID correlations. For complete AGRASID 3.0 correlations refer to Appendix B.

[Y]Ecological range Site	Revised Definition	AGRASID 3.0 Correlation
[X]Water (Wa)	Any permanent open body of water, including lakes, reservoirs and rivers.	Undifferentiated water bodies (ZWA) if associated with a water-dominated landscape model (W1, W2, or W3).
Subirrigated (Sb)	Water table is close to surface during growing season, but rarely above.	Gleyed non-saline medium- to coarse-textured soils. Limited occurrences in AGRASID.
Riparian (Ri)	Zone most closely adjacent to stream and river channels. Also known as the lotic zone.	Any SLM that uses landscape models of stream channel or floodplain (SC1-l, SC1-h, SC2, SC3, SC4, FP1, FP2, or FP3).
Overflow (Ov)	Areas subject to water spreading and sheetflow. Typically on gentle inclines or terraces prone to stream overflow.	Inclined, low relief landscapes including fans and aprons; or soils developed on fans, aprons or terraces.
Wetland (WL)	Typically low-lying or depressional positions subject to occupation by water ranging from temporary to semi-permanent in duration. Also known as the lentic zone.	Non or weakly saline Gleysols or Organic soils or undifferentiated water bodies (ZWA), with any landscape model other than W1, W2 or W3.
Clayey (Cy)	Clayey (heavy) textured soils including silty clay, sandy clay, clay, and heavy clay. Generally >40% clay content.	Fine- and very-fine-textured soil groups.
[W]Loamy (Lo)	Most common soil textural group on the prairies, including loam, silt loam, silt, clay loam, sandy clay loam, and silty clay loam.	Medium- and moderately-fine textured soil groups.
Sandy (Sy)	Sandy-loam-textured soils.	Moderately coarse-textured soil group.
Limy (Li)	Eroded or immature soils with free lime precipitate ($CaCO_3$) at the soil surface. Moderately to strongly alkaline with pH generally >7.5.	Eroded, Rego and Calcareous soils or subgroups.
Sand (Sa)	Loamy sand and sand soils, and not with a duned surface.	Very-coarse-textured soil group and not on duned landscape models.
Blowouts (BlO)	Areas with eroded surface pits reflecting the presence of abundant Solonetzic (hardpan) soils.	Dominant or Co-dominant Solonetzic Order Soils.
Choppy Sandhills (CS)	Loamy sand and sand soils with a duned land surface.	Very-coarse-textured soil groups with duned landscape models.
Thin Breaks (TB)	Areas with bedrock at or near the soil surface, largely vegetated. May include thin, eroded or immature soils and the landscape	Specific landscape models I3m and I3h; OR specific layered, medium, or fine soil materials denoted by AGRASID PM (parent material)

[Y]Ecological range Site	Revised Definition	AGRASID 3.0 Correlation
	may range from gentle to steep.	codes L6, L7, L8, L16, M5, or F5.
Shallow to Gravel (SwG)	Soil with 20 to 50 cm of a sandy or loamy surface overlying a gravel or cobble- rich substrate. Usually >20% coarse fragments.	Specific layered soil materials denoted by AGRASID PM (parent material) codes L4 or L5.
Saline Lowland (SL)	Saline (sodium-sulfate rich) lowland areas subject to flooding and with limited or negligible plant growth due to electrical conductivity or sodium adsorption ratio limitations.	Saline Regosolic or Saline Gleysolic soils, or highly sodic Regosols.
Gravel (Gr)	Areas dominated by gravel- or cobble-rich soil (>50% coarse fragments). A surface mantle with few stones may occur but is less than 20 cm thick.	Specific layered and coarse soil materials denoted by AGRASID PM codes L1, L17, L19, L21 or C1.
Badlands/ Bedrock (BdL)	Nearly barren lands dominated by local softrock or hardrock geological features. Includes valleys with steep sides and bedrock exposures.	Specific Landscape Models I4h, I5.
[X]Urban (Urb)	Cities, towns, or disturbed lands.	Any SLM that uses the disturbed land landscape model (DL).

[Z]Definitions in Table 3 were revised and updated for this report.
[Y]Ecological range sites are listed in order from most productive to least productive.
[X]Water and Urban do not meet the technical definition of ecological range sites, but they were identified for this project.
[W]The reference plant community (site potential) for the Loamy ecological range site is considered to be the most representative and the modal (central) for the Natural Subregion.

Other ecological range sites required modification to be compatible with AGRASID. For example, Clayey was originally defined as "All normal, relatively pervious, sandy to silty clay loams and clays – normally granular" (Wroe et al. 1988). However, this definition includes some medium-textured soils that are much more suitable in the loamy category. It is therefore more practical to restrict clayey soils to soils with greater than 40% clay. Therefore, the AGRASID-compatible definition is restricted to fine- and very-fine-textured soils.

Wroe et al. (1988) listed the range sites in groupings of natural productivity. For the current study, the individual range sites were assigned an intuitive ranking from most productive to least productive (Table 3). This ranking will be validated in the development of further plant community descriptions by Alberta Public Lands. The rankings are not quantifiable, but they were necessary to develop the GIS. Each ecological range site was assigned current updated definitions, and a specific AGRASID match. For SLMs with co-dominant soils, the co-dominant soil series that is most limiting to production is linked to the corresponding range site and plant community.

Table 4 lists the five ecological range sites and their associated plant communities in the Foothills Fescue - South Natural Subregion (SCA5) that were initially provided by Alberta Public Lands (APL) staff. LandWise Inc. and Public Lands identified nine

additional ecological range sites that probably occur in this Subregion. Several occur in both SCAs 5 and 6, while others are specific to a single SCA. Only limited site-characterization data is available for five of the new ecological range sites (FFA19 to FFA23 in Table 4). Plant communities for four of the additional ecological range sites have not yet been characterized, due to very limited sample size. The nine additional ecological range sites will be sampled in the future to increase confidence in the currently identified plant communities. Each ecological range site was assigned a relative rank number to indicate relative productivity (Table 4).

Table 4. Reference plant communities and ecological range sites in the pilot area (the Foothills Fescue - South Natural Subregion, or SCA5).

Category	Plant Community Number	Range Site	Relative Rank	Plant Community	N= sample size
Plant communities and descriptions provided by Public Lands for SCA5	FFA01	Ov	5.2.1	Foothills Rough Fescue – Idaho Fescue – Western Wheat Grass	9
	FFA02	Lo	5.5.2	Foothills Rough Fescue – Idaho Fescue – Sedge	36
	FFA09	SwG	5.12.1	Foothills Rough Fescue – Parry Oatgrass	15
	FFA13	Gr	5.14.1	Foothills Rough Fescue – Idaho Fescue – June Grass	9
	FFA17	TB	5.11.1	Foothills Rough Fescue – Parry Oatgrass – June Grass	6
Additional plant community numbers added during the study	FFA19	Li	5.7.1; 6.7.1	Western Wheatgrass – Little Bluestem; applies to both SCAs 5 and 6	
	FFA20	BlO	5.9.1; 6.9.1	Rough Fescue – Western Wheatgrass; applies to both SCAs 5 and 6	
	FFA21	Cy	5.4.1; 6.4.1	Western Wheatgrass; applies to both SCAs 5 and 6	
	FFA22	Sy	5.6.1; 6.6.1	Rough Fescue – Western Porcupine Grass; applies to both SCAs 5 and 6	
	FFA23	Lo	6.5.2	Rough Fescue – Western Porcupine Grass – Green Needle Grass	
	FFA24	SL	6.13.2	not characterized; to be determined	
	FFA25	Sa	6.8.1	not characterized; to be determined	
	FFA25	CS	6.10.1	not characterized; to be determined	
	--------	BdL	6.15.1	not characterized; to be determined	

AGRASID and Other Information Used for Rule Building

Rules were developed to link ecological range sites and plant communities to the 13,371 AGRASID polygons in the study area. The rules were designed to apply to all or almost all Soil Landscape Models (SLMs). The rules were originally based on AGRASID categories, as summarized in Table 5. Some of these rules required subsequent modification, as explained in more detail below. After several iterations of rule building it was concluded that soil series was the most useful AGRASID category for linking SLMs to ecological range sites. Some of the categories listed in Table 5 were retained, including the landscape models and the undifferentiated soil models in combination with landscape models. Refer to Appendix B for the complete rules developed after the final iteration.

Table 5. AGRASID categories originally used to link SLMs to ecological range sites.

AGRASID Category (file)	Ecological Range Site
Parent Material (PM)	Clayey (Cy), Loamy (Lo), Sandy (Sy), Sand (Sa), Thin Breaks (TB), Shallow to Gravel (SwG), and Gravel (Gr)
Drainage classes (mas wet)	Sub-irrigated (Sb) and Wetland (WL)
Regional Soil Choice	Blowout (BlO)
Landscape Models	Riparian (Ri), Overflow (Ov) and Badlands (BdL)
Regional Soil Choice in combination with Landscape Models	Choppy Sandhills (CS)
Soil Series	Limy (Li) and Saline Lowland (SL)
Undiferrentiated Soil Models in combination with Landscape Models	Water (Wa) and Urban (Urb)

Parent Material Codes

The AGRASID Parent Material code (PM) (hereafter referred to as PM) was initially used for linking soils information to ecological range sites. There were very few problems with using only the PM codes for the Cy, Lo and Sy ecological range sites in the pilot area. For example, the PM codes for fine-textured soils (FO, F1, F2, F3 and F4) accounted for all clayey SLMs, which were all linked directly to the Cy ecological range site. The manual listing that assigned ecological range sites to SLMs was entirely consistent with the first computer run based on linking the "PM" codes of FO to F4 to the Cy ecological range site.

The above ecological range sites that could be linked to AGRASID parent material codes are based largely on texture. Problems arose for ecological range sites that are not directly related to texture, including Thin Breaks (TB), Shallow to Gravel (SwG) and Gravel (Gr). AGRASID SLMs that should link to these ecological range sites were not consistently coded with PM codes that could be directly linked. For example, thin till over bedrock was sometimes recorded as "till" in AGRASID, with the result that it would not be automatically linked to TB using the AGRASID parent material code.

AGRASID soil series codes were found to be more appropriate than PM codes for linking SLMs to ecological range sites, largely because they describe soil classification in combination with parent material. For example, the Ockey (OKY) soil series describes an Orthic Black Chernozem developed on till veneer overlying bedrock, so it can be directly linked to the TB ecological range site. Although soil series codes were therefore used in preference to parent material codes, the PM codes were retained as an initial split. The pilot area contained 48 soil series, while the complete study area contained 257 soil series. In comparison, AGRASID contains 43 mineral soil parent material codes for Alberta, and only about 15 of them are used commonly. The larger number of soil series codes, in addition to their more detailed description, allowed for a much more accurate linkage to ecological range sites.

In summary, the soil series category was found to be more appropriate than parent material codes to link to most ecological range sites.

Drainage Classes

The two ecological range sites that could potentially be linked to AGRASID drainage classes are Sub-irrigated (Sb) and Wetland (WL). AGRASID drainage symbols (mas wet, Table 6) are not suitable for direct linkage to ecological range sites, mainly because each SLM often contains numerous areas with different drainage. For example, a complex SLM with two co-dominant soils and two significant soils could have each of the four soils assigned to a different mas wet category. In addition, AGRASID was found to contain some errors in the assigned mas wet symbol. For example, Gleysolic soils are poorly drained, but were sometimes entered as imperfectly drained or with no chosen field.

Table 6. AGRASID drainage symbols.

AGRASID Symbol	Description
FD	freely drained
I	imperfectly drained
P	poorly drained
AP	area ponding

Since AGRASID drainage classes were not suitable for linkage to ecological range sites, soil series and their soil model codes were used to indicate the WL and Sb ecological range sites.

Regional Soil Choice

The "Regional Soil Choice" file in AGRASID generally indicates the dominant or co-dominant Soil Order or Soil Great Group for the region. For example, Dark Brown Chernozemic is distinguished from Brown Chernozemic, Thin Black Chernozemic, and Solonetzic, among others. The Regional Soil Choice of Solonetzic was originally considered to be the most useful way to identify dominant or co-dominant Solonetzic SLMs. However, the Regional Soil Choice was not always entered by AGRASID

analysts, and was sometimes entered incorrectly. For example, the Regional Soil Choice "Solonetzic" was occasionally observed for SLMs that only had significant (i.e. 15 to 30%) Solonetzic soils. Soil series were therefore a more reliable way to identify SLMs with dominant or co-dominant Solonetzic soil models, which were directly linked to the Blowout (BlO) ecological range site.

Landscape Models

AGRASID landscape models were found to be very useful for identifying the Overflow (Ov), Badlands (BdL) and Riparian (Ri) ecological range sites, but were generally not useful for other ecological range sites.

The Overflow (Ov) ecological range site is commonly represented by the I3l landscape model (low relief inclined fan and apron deposits that receive input from streams). For these SLMs, 50% of the area was assigned to the Ov ecological range site, because only a portion of fan and apron areas is subject to sheet flow from streams.

Some SCAs contain sizeable areas of fans and aprons, recognized by specific soil series, including BUT in SCA1, HLM in SCA5, and BKF in SCA4. These soil series may occur on the landscape model I3l, but they also occur on low-relief landscapes that are also prone to overflow. The percentages of each SLM assigned to the Overflow ecological range site, based on eligible soil series, varies slightly from SCA to SCA. Refer to Appendix B for details.

Badlands are typically considered to be areas with sparse to negligible vegetation due to exposed softrock sediments, such as at Dinosaur Provincial Park. The definition of the Badlands (BdL) ecological range site was broadened for the current project to include areas of exposed hardrock geology, such as the Wildcat Hills near Cochrane, and the Whaleback Ridge south of Longview. The landscape models I4h (inclined to steep sloping landforms with greater than 10% exposed bedrock) and I5 (inclined steep lands with extensive failure slumps) were directly linked to the Badlands/bedrock (BdL) ecological range site.

The rules were written to automatically link any stream channel or floodplain landscape model with the Riparian (Ri) ecological range site. Due to the scale of AGRASID (1:100,000), a single SLM often includes coulee banks and stream channels within the same SLM. The landscape models in these SLMs are usually described as stream channels or floodplains, but are sometimes described as undulating or level areas. SLMs mapped as undulating or level areas in stream courses may be linked to Gravel (Gr) or Sand (Sa) ecological range sites. Therefore, because the current project is based on linkage with AGRASID at a scale of 1:100,000, the Riparian ecological range site may not always be mapped in the correct locations. Mapping of the Riparian ecological range site would be improved by linking the provincial DEM to AGRASID and the Native Prairie Baseline Inventory for all stream corridors.

Regional Soil Choice in Combination with Landscape Models

The Choppy Sandhills (CS) ecological range site represents immature sand-dominated soils in a duned landscape setting. The AGRASID Regional Soil Choice of Regosolic generally links directly to the CS ecological range site throughout all grassland areas in the Southern Region. However, in the Aspen Parkland (SCA9) the CS ecological range site is best linked to the Regional Soil Choice of Black Chernozemic, because the lower rate of evapotranspiration and the higher rate of precipitation have allowed the development of Chernozemic soils. Even in the Grassland areas, Regional Soil Choice is sometimes not identified, or not identified correctly in AGRASID.

Therefore, specific soil series combined with duned landscape models were found to be the most reliable and practical way to link AGRASID to the CS ecological range site. For example, in SCA6, the Ardenode (ARE) soil series was linked to CS if it occurred with any of the six duned landscape models (D1l, D2l, D1m, D2m, D1h or D2h).

Soil Series

AGRASID soil series was the most suitable category for linking SLMs to the Limy (Li) and Saline Lowland (SL) ecological range sites. The Limy ecological range site is represented by soils with a surface pH greater than 7.5, because they are either calcareous, lack a B horizon (Rego), or have a thin solum. No individual AGRASID field indicates surface pH, but calcareous soils, absence of a B horizon, and thin solums are all characteristics of individual soil series. For example, soil series in SCA5 that belong to the Limy ecological range site include CWY, ODM and PSO.

The Saline Lowland ecological range site tends to occur in basins or adjacent to basins, and is represented by Saline and/or Sodic Regosolic or Saline Gleysolic soils. These areas receive additional surface waters containing sodium and sulphate salts, which tend to concentrate as the water evaporates. No individual AGRASID field indicates the presence of co-dominant or dominant salinity. The AGRASID salinity field only indicates the presence or absence of salts, which can range in extent from minor to dominant. Therefore, individual soil series that are characterized by Saline and/or Sodic Regosolic or Saline Gleysolic soils provide the best link to the Saline Lowland ecological range site.

SLMs that contained the same dominant and co-dominant soils but different significant soils were generally linked to the same range sites, with the exception of cases where the significant soils caused association with a different reference plant community. For example, almost all SLMs where the Maleb soils series (MAB) was dominant were linked to DMA02, with the exception of MAB7, 10, 14, 15 and 17. The latter five soil models were linked to DMA01 because the presence of significant Solonetzic soils changed the reference plant community.

In summary, soil series was found to be the most useful AGRASID category for linking most SLMs to ecological range sites. Therefore, all soil series present in each SCA are used in the rules for that SCA.

Undifferentiated Soil Models in Combination with Landscape Models
Undifferentiated soil models address soil landscapes that do not fit within the conventional models. For example, cities, towns and disturbed land, are specifically represented by the undifferentiated mineral soil model (ZUN) on the disturbed land landscape model (DL). Therefore all uses of ZUN/DL were assigned to the Urban (Urb) ecological range site. Some towns have not been identified as DL in AGRASID, including Vulcan and Nanton, and they are therefore not indicated on the final map product.

Water bodies are represented in AGRASID through use of either the undifferentiated water body (ZWA) soil model, or landscape models that are dominated by water (W1, W2 or W3). For this project, it was decided to assign only permanent water bodies including lakes, reservoirs and rivers, to water. Therefore, all ZWAs on non-water landscape models were assigned to the Wetland ecological range site. Some AGRASID polygons had to be assigned manually, based on the knowledge of the area. For example, Sullivan Lake is only a semi-permanent water body, so it was changed from a water body (ZWA) to a non-water landscape model, allowing it to be linked to the Wetland ecological range site.

Additional Information
The AGRASID-based rules described in the previous section were refined for some ecological range sites to accommodate plant community information provided by Alberta Public Lands. The refinements were accomplished using AGRASID Land Systems, the provincial 1:20,000 digital elevation model, and the Alberta Vegetation Inventory (AVI).

AGRASID Land Systems. Some ecological range sites contained two, three or four unique plant communities, due to regional variations within the natural sub-region. For example, the Loamy ecological range site in SCA1, the Dry Mixed Grass Natural Subregion, encompassed three major areas, each characterized by unique plant communities.

- DMA01: Solonetzic Chernozems or Orthic Chernozems with a significant proportion of Solonetzic soils; occurs anywhere in the Dry Mixed Grass.
- DMA02: Major Dry Mixed Grass Loamy unit. Orthic Chernozems, including those Land Systems that border the Sweetgrass Hills or the Milk River Ridge that <u>are</u> strongly rolling, ridged or hummocky.
- DMA03: Orthic Chernozems in Land Systems that border the Sweetgrass Hills or the Milk River Ridge, provided they are on landscapes that <u>are not</u> strongly rolling, ridged or hummocky.

DMA02 and DMA03 were identified based on AGRASID Land Systems that border the Sweetgrass Hills and the Milk River Ridge, in addition to identifying the appropriate SLMs. DMA01 required only the identification of the appropriate SLMs (Appendix B).

Land Systems were also used to separate the loamy high-elevation areas bordering and including the Cypress Hills plateau and escarpment from the loamy lower elevation areas

of the Cypress Hills that border the Dry Mixed Grass Natural Subregion. (See MGA01 and MGA04 in Appendix B).

Land Systems were also used to develop rules to isolate the Black soils on the highland portion of the Hand Hills to Plant Community NFA22, and to separate them from the other two loamy ecological range sites in SCA4. (See Appendix B).

Provincial Digital Elevation Model. Alberta Public Lands has detailed plant community information in the Milk River Ridge and Sweetgrass Hills area of the Mixed Grass Highlands in SCA2. Two Loamy ecological range sites and plant communities in this area show a strong correlation to elevation. MGA12 occurs generally in the range of 1100 to 1280 m, and generally at an average of 1200 m. MGA15 occurs in the range of 1050 to 1200 m, and generally at an average of 1100 m. The provincial 1:20,000-scale digital elevation model (DEM) was used in combination with AGRASID SLMs to separate these two ecological range sites and their associated plant communities.

The provincial DEM was also used for developing rules for MGA15 in areas that border the Milk River Ridge in SCA3, the Mixed Grass Plains. SLMs in the Warner – Milk River Ridge Reservoir area that were identified at elevations greater than 1050 m were assigned to MGA15.

Alberta Vegetation Inventory (AVI). The Alberta Vegetation Inventory (AVI) was used in SCA8, the Foothills Parkland Natural Subregion, to help isolate FPA06, which is a lodgepole pine forested community. AVI spatial data on Pine forests was overlaid with AGRASID to determine acceptable Loamy SLMs. Any Loamy SLMs within FPA10, FPA03 or FPA04 that coincided with locations of Pine in the AVI data were automatically assigned to FPA06-Lo.

The use of the AVI was also attempted for the splitting of Sedge wetlands from the Dwarf Birch wetlands in SCA8, but it was not found to be useful due to the very detailed scale of the AVI, compared with the 64-ha minimum SLM size in AGRASID.

Rule Building in the Pilot Area

Results of the Manual Listing

LandWise Inc. initially prepared a manual list linking ecological range sites and plant communities to the 1243 AGRASID polygons in SCAs 5 and 6. The manual list served to identify gaps in the rules prior to the first run of the computer process. As a result of this initial manual comparison, 118 polygons (9%) were flagged because rules did not exist or were incomplete. Flagged items and the solutions determined before the first computer run are detailed below.

- 41 polygons with the I31 landscape model or the Hillmer soil series as either dominant (HLM) or co-dominant (HL in the code as either the first two or the last two letters) did not initially get assigned to an ecological range site. After discussion with Alberta Public Lands, it was initially decided that a certain percentage of the area of

each of these SLMs would be assigned to the Overflow (Ov) ecological range site. The percentages were 30% for HLM, 15% for HL, and 50% for I3l.

- 29 polygons that contained Rockford (RFD or RF) as the dominant or co-dominant soil series were initially assigned to the Gravel (Gr) ecolgical/range site. The RFD soil series describes a cobbly and stony variant of medium- to moderately-coarse-textured glaciofluvial material. This soil series could be included in any of the following ecological range sites: Sandy (Sy), Loamy (Lo), Shallow to Gravel (SwG), or Gravel (Gr). A later discussion with the AAFC reviewer indicated that the SwG ecological range site would be the most appropriate choice.

- 28 polygons were undifferentiated soil models containing the Z prefix. E.g., ZUN for undifferentiated mineral soils, and ZCO for undifferentiated coarse soils. The 28 SLMs had a variety of soil model numbers, and an even wider variety of landscape models. It was therefore necessary to assign these SLMs to ecological range sites on an individual basis using the best information at hand (soil surveys or any other data sources). After the SLMs were assigned manually to ecological range sites, rules were developed for some of the 28 "Z" SLMs. For example, the soil model "ZER" (undifferentiated eroded soils) was assigned to the Limy (Li) ecological range site provided the associated landscape model was not I3l or I3h, I4m or I4h.

- 20 polygons contained co-dominant wetland components in combination with other co-dominant soils. Two potential solutions were possible: 1) to assign the most limiting ecological range site to the entire SLM; or 2) to assign 50% of the SLM to Wetland (WL) and the other 50% to the other most representative ecological range site. The review team suggested the use of the second choice before the initial computer run.

Initial Computer Run

When the initial rules were first run through the computer process for the 1243 AGRASID polygons in SCAs 5 and 6, only 53 polygons (4.3%) were unclassified, for the following reasons.

- The initial draft of rules neglected to specify two soil series associated with dominant wetlands in SCA6 (DWT and IND) (28 polygons). These were then added to the rules for the next iteration.

- The Overflow rules did not initially work properly for 14 polygons with Hillmer (HLM) soil models due to a revised decision and a technical problem. The team made a change to assign 20% of SLMs with the HLM soil model to the Overflow (Ov) ecological range, and 10% of SLMs with co-dominant HL, with the remaining portions assigned to the Loamy (Lo) ecological range site. The rules did not execute the Ov and Lo split properly in the first computer run, but they were corrected for subsequent iterations.

- An additional five of the unclassified AGRASID polygons were those containing co-dominant wetlands. The rules did not include SLMs with co-dominant undifferentiated Gleysols (ZG) or undifferentiated Water areas (ZW). ZW indicates

co-dominant water, but if the landscape model is not water (W1,W2 or W3) then it is interpreted as a wetland. These SLMs were classified in subsequent iterations by assigning 50% of the SLM to the Wetlands (WL) ecological range site, and 50% to the other co-dominant ecological range site.

- The remaining four unclassified AGRASID polygons were undifferentiated and miscellaneous land types for which it would have been difficult to foresee the rules that would be required. For example, complex SLMs including variant codes such as the zb (Brunisolic) in ZCOzb11/I3mc could not have been predicted to occur. These four polygons were dealt with on an individual basis, and the ecological range sites and plant communities were assigned manually rather than automatically.

Subsequent Computer Runs and Map Development

Results of the second and subsequent computer runs were used to develop maps showing ecological range sites for the pilot area. These maps were used to refine the rules. Nine polygons (0.7%) were questioned following the final computer iteration. The nine polygons rarely occur in the study area, and some occur only in SCAs 5 or 6.. It was therefore more appropriate to manually manipulate the rules for these few polygons, rather than change the rules and potentially cause problems for rules in other SCAs. The problem with most of the nine polygons was that the AGRASID description required modification to more accurately represent soil and landscape conditions. For example, three ZUN/U1h polygons that occurred in the Bieseker area (SCA6) were narrow and sinuous polygons, implying possible riparian corridors. These polygons were checked on the MD of Rockyview Soil Survey (1:50,000), and were confirmed as stream channels. The AGRASID landscape models were revised to the most appropriate low-relief stream channel (SC1-l) for the current project, and the SLMs were then automatically assigned to the Riparian (Ri) ecological range site.

Refinements of the Map Product

Several iterations of rule building and checking of the map product were conducted to detect and remove all errors and inconsistencies from the final product.

For the MGA19 plant community in SCA2, and for each SLM with a significant portion of Solonetzic soils, 20% of the SLM was assigned to the Blowout ecological range site. The remaining 80% was assigned to the Loamy ecological range site. The rule was initially input incorrectly into the model, so that 100% of these SLMs were assigned to the Blowout ecological range site. This resulted in an over-representation of the Blowout ecological range site in SCA2. This error was detected when comparing the GIS map products with existing soil survey and AGRASID source information.

The large area of gravels encircling the Cypress Hills Plateau in SCA2 was modified based on discussion with the review team. Originally the co-dominant and dominant gravelly soils RSR and DMS were linked to the Gravel ecological range site. It was later agreed that co-dominant gravelly soils are best represented in the Loamy ecological range site, since they are seldom compromised by drought in this moister, high-elevation area.

Dominant gravelly soils, which are more prone to impact from drought, were kept in the Gravel ecological range site. For details refer to Appendix B.

An ecological range site (plant community DMA04) that combined Clayey and Blowout was originally defined for SCA1. It included fine-textured Chernozemic and weakly-expressed Solonetzic soils. After review and confirmation with the review team, the Brown Solod soil RMR was moved to the plant community DMA13, and DMA04 was changed to a Clayey ecological range site. The new DMA04 is now represented by both Orthic and Solonetzic Chernozemic fine-textured soils.

Originally the KGO soil series in SCA1 was assigned to the Gravel ecological range site, but after review and discussion it was reassigned to the Sands ecological range site, and plant community DMA07.

Specific Enhancements to AGRASID for the Purposes of This Project

Once the initial model was developed and used to produce initial maps, LandWise Inc. staff systematically studied the GIS map products for the entire study area. The AGRASID Soil Names File was also checked in detail to ensure all 257 soil series in the study area were included in the ALCES rules. The following section describes changes that were made to the model to remove inconsistencies and errors in the linkage between AGRASID and ecological range sites.

Changes to Soil Series Symbols

Some three-letter AGRASID soil series share the same first two letters with other soil series within the same SCA. In this case the three-letter symbol for one of the series was changed so that the computer model would recognize each unique Soil Series (Table 7).

Table 7. Soil Series Symbols that were changed to facilitate rule building.

SCA	Old Symbol	Changed to	To Avoid Confusion With
1	WDN	WHN	WDW
1	SIG	SRG	SIL
1	CHZ	CIZ	CHN
1	DHP	DSP	DHS
3	KCP	KYS	KCH
3	NED	NDA	NEM

For example, the initial rules interpreted a Kirchamp (KCH) soil series in SCA3 as a Kyiscap (KCP), and therefore linked an SLM with the KCH soil series with the Saline Lowland ecological range site, rather than with the Clayey/Loamy ecological range site.

Changes to Avoid Confusion with the Stony Variant

Soil series symbols in some AGRASID SLMs are followed by two small letters indicating variants. For example, MAstCF indicates a stony variant of the co-dominant

Maleb series in association with a co-dominant Cranford soil series. ArcView does not distinguish upper case and lower case letters. As a result, the MAstCF SLM was interpreted as the MAST SLM, indicating co-dominant Maleb and Stirling soils. The program rules therefore linked the MAstCF SLM to the Blowout (BlO) ecological range site, even though it was intended to be linked to the Loamy (Lo) ecological range site. To circumvent this problem, the Stirling symbol was changed from STG (originally SIG as in Table 4) to SRG. After checking all 48 of the variant codes, no other variants conflicted with soil series in the study area.

Corrections to SLMs Identified Incorrectly in AGRASID

During review of the map products, several AGRASID SLMs were found to be incorrectly coded, based on the author's knowledge of the locations. The incorrectly-coded SLMs were manually changed to the most appropriate ecological range site and plant community. It is suggested that AGRASID should be edited to include these corrections. SLMs requiring correction are detailed below.

Two SLMs in Township 9, Ranges 23 and 24, one in the Pearce Block northeast of Ft. McLeod, and a smaller polygon east of Monarch, were coded as duned landscapes in AGRASID, but they are actually a loess plain with ridges that are defined by prevailing wind direction. The AGRASID landscape model should therefore be changed from duned to ridged. The incorrect landscape model resulted in these SLMs being linked with the Choppy Sandhills (CS) ecological range site. Upon modification in the model, they are now linked with the Sandy (Sy) ecological range site.

The Oldman river valley banks north and east of Lethbridge to the Little Bow River have been wrongly coded as an I4h landscape model (>10% softrock exposures). They should be correctly coded as I3h (<10% softrock exposure). The incorrect coding caused these SLMs to be linked with the Badlands ecological range site. The applicable SLMs were modified manually to link with the Think Breaks ecological range site.

An SLM in the southwest corner of Township 30, Ranges 13 and 14, was wrongly coded as a stream channel. This SLM should be changed to I3m-d, indicating a moderate-relief inclined landscape with numerous gullies. The incorrect coding caused this SLM to be linked with the Riparian ecological range site, rather than the correct ecological range site of Thin Breaks.

An SLM in Township 31, Ranges 15 and 16, was incorrectly coded as a floodplain, but there is no active stream in this location, so the code should be changed to low-relief undulating (U1l). The soil model is indicated as undifferentiated mineral soils (ZUN) and should be changed to undifferentiated Solonetzic soils (ZSZ). Manual modification of the SLM resulted in changing the ecological range site linkage from Riparian to Blowout 1.

Sullivan Lake (centered on Township 35, Range 14 –W4) and an unnamed smaller lake immediately north and east of Sullivan Lake, were wrongly coded as water (ZWA/W3). These SLMs should actually be coded as wetlands, as they are not permanent water

bodies. The landscape model was changed from W3 to L2 for this project, so that these basins were linked with the Wetland ecological range site, rather than the Water ecological range site.

An SLM in the Beaver Creek watershed, in Townships 9 and 10, Ranges 29 and 30-W4, was incorrectly coded as I4h (high-relief inclined with bedrock exposures >10%). The correct code is I3h-r, indicating bedrock exposures <10% but with bedrock control. Manual modification of the SLM changed the linkage with ecological range sites from Badlands/Bedrock to Thin Breaks.

DISCLAIMERS

- For SLMs with co-dominant soils, the soil series that is most limiting to range production is linked to the corresponding ecological range site and the reference plant community. The ranking used in the GIS is based on an established understanding of range site productivity associated with the Alberta stocking guide (Wroe et. al 1988), and is used for comparative purposes only. Although the ranking is currently only relative, it will probably be quantified in the future, as knowledge of ecological range sites expands.
- The linkages between AGRASID polygons and ecological range sites and reference plant communities rely on the reliability of AGRASID data. The map product generally applies on an AGRASID polygon basis, rather than a site-specific basis. Multiple ecological range sites occasionally occur within one SLM, but this project selects only the ecological range site that is most limiting to range productivity. SLMs that contained the same dominant and co-dominant soils but different significant soils were generally linked to the same range sites, with the exception of cases where the significant soils caused association with a different reference plant community.
- The GIS map product assumes that plant community boundaries coincide with AGRASID boundaries. In reality, plant community boundaries will also be influenced by sun angle, aspect, and numerous other factors. Plant community boundaries may grade into one another over many kilometers, particularly in level and undulating areas. Plant community boundaries may not coincide with SLM boundaries, and on a site-specific basis, the identified plant community may not occur in the identified ecological range site.
- The reference plant community associated with each ecological range site is based on site expression of potential natural community, or the plant community that would exist when the range is in good to excellent condition. In reality, range plant communities may exist at lower seral stages of plant succession, previously termed fair and poor condition, now termed unhealthy or healthy with problems. Lower seral stages are due mainly to alteration by grazing, with a resulting dominance of more grazing-resistant species.
- Some plant communities are first approximations and will be revised as additional vegetation survey data becomes available.

- Some of the native rangeland mapped as grassland cover in the Native Prairie Vegetation Inventory may be modified rangeland implying grassland that has become more or less permanently invaded by agronomic species like Timothy, smooth brome, Kentucky bluegrass and crested wheatgrass.
- The rules used to develop this GIS map product are a best attempt based on testing and validation as explained in this report.

SUMMARY

Rules were developed to link ecological range sites and corresponding potential plant communities to the 13,371 AGRASID polygons in the study area. The AGRASID soil series category was found to be most useful for linking the two types of information, and all soil series present in each SCA are used in the rules for that SCA. Additional AGRASID categories, including parent material, drainage, regional soil choice, landscape models, and land systems, were used to supplement the soil series information. The provincial digital elevation model and the Alberta Vegetation Inventory were also used for some rules. For SLMs with co-dominant soils, the soil series that is most limiting to range production is linked to the corresponding ecological range site and plant community. Ecological range sites were ranked in order of relative range productivity. Some plant communities require additional sampling in the future to characterize or confirm their identity and presence. The GIS map product could be improved for all ecological range sites by linking to various information sources, including the provincial DEM, satellite imagery, and the Native Prairie Baseline Inventory. The Riparian ecological range site could serve as the test case for studying potential improvements, including avoiding the over- or under-representation of riparian areas.

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Appendix A
Example of Ecological Range Sites Linked to Soil Series in SCA5, From LandWise Inc. (1998, 2001).

Soil Series of Soil Correlation Area (SCA) 5 Linked to Ecological Range Sites

Natural Subregion: Foothills Fescue (South)
SCA5: Black soil zone of south-western Alberta

Productivity Rating	Ecological/Range Site	Soil or Landscape Description	[Z]Soil Series
More herbage due to superior soil moisture	Overflow (Ov)	Fan, apron, channeled or concave (non-saline) landscapes	**HLM, LVY, SND**
	Subirrigated (Sb)	Gleyed; imperfectly drained (CSSC 1998)	
	Wetlands (WL)	Gleysols; poorly drained (CSSC 1998)	JAT, ZGW
Normal vegetation response	Clayey (Cy)	Fine (FI) or very fine (VF) textures (see Fig.)	CTN, PNR, **SND, CWY**
	Loamy (Lo)	Medium (ME) or moderately fine (MF) textures (see Fig.)	BUL, BZR, DLB, **HLM, ODM, OWD, RFD**, SAK, SOF
	Sandy (Sy)	Moderately coarse (MC); or very coarse (VC) veneer over medium (ME) textures	KNT, **LVY**
Limited by moisture (or soluble salts adversely affecting plant growth)	Badlands (BdL)	Bedrock exposures >10%, and bedrock generally <1m deep; AGRASID landscape models include I4, I4m, and I5	
	Blowouts (BlO)	Dominant or co-dominant soils in the Solonetzic order (CSSC 1998)	CGE, KGT, NNK, **OXY**, PGN, MAM
	Choppy Sandhills (CS)	Duned landscape models; very coarse (VC) textures (see Fig.)	
	Gravel (Gr)	Gravels at the surface or <30 cm from the surface	RND
	Limy (Li)	Calcareous or Rego subgroups; or eroded phases (CSSC 1998)	**CWY, MKN, ODM**, PSO, ZER, [Y]WOLaa
	Saline Lowlands (SL)	Saline discharge; salt-enriched	ZNA
	Sands (Sa)	Very coarse (VC) and not duned (CSSC 1998)	
	Shallow to Gravel (SwG)	veneer (30 – 100 cm) over gravels	BFT, **RFD**
	Thin Breaks (TB)	Bedrock generally, 1 - 5 m; bedrock exposures <10%	**MKN**, NFK, OKY, **OWD, OXY**

[Z]For a complete description of soil series attributes please refer to the Soil Names file in AGRASID 3.0 (www.agric.gov.ab.ca/asic).

[Y] aa: indicates oil series that occur mainly in a bordering SCA, with only a small area in this SCA.

Note: Soil series codes in bold occur in more than one ecological/range site.

Appendix B

Rules Linking AGRASID SLMs to Ecological Range Sites and Their Reference Plant Communities

Reference Plant Communities of SCA1 (Dry Mixed Grass Natural Subregion – Brown Soils in Southeastern Alberta) as Related By Ecological Range Site – Soil Landscape Model Correlations Rule Building, LandWise Inc.

Soil Landscape Models (SLMs) are indicated as soil series unit number/landscape model (e.g. MAB10/U1h). Three-letter soil series codes indicate that one soil series is dominant (e.g., Maleb = MAB). SLMs with four-letter soil series codes indicate two co-dominant soil series that are represented by the first two and the last two letters (e.g., Maleb-Cranford = MACF). Unit numbers range from 1 to 22 (10 in the above example), and represent a particular assemblage of significant soils. The landscape model indicates surface form, relief and slope characteristics. Refer to AGRASID 3.0 for further details (ASIC 2001).

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
———	[Y]Wa 1.0.0	Use for the undifferentiated soil model ZWA only if associated with a water-dominated landscape model (W1, W2, or W3).	Any permanent body of water; (e.g., lakes, reservoirs and rivers).
DMA17 not characterized	Sb 1.1.1	Use for all 3-letter [X]SLMs coded as MHN; **OR** for all 4-letter SLMs with MH in the code as either of the first two or the last two letters, 50% of the SLM is DMA17 – Sb; **OR** for SLMs where the dominant or co-dominant PM equals C0 or C2 AND with the soil model unit #2, 8, 9, 12 or 18, 15% of the SLM is DMA17-Sb (the other 85% is assigned to Sa or CS).	Correlates to MHN soil series. Limited occurrences in SCA 1.
Complex	[Y]Ri 1.1.5	Use for landscape models of stream channel or floodplain (SC1-l, SC1-h, SC2, SC3, SC4, FP1, FP2, or FP3); **OR** any soil model coded as VGR (Verdigris).	The zone most closely adjacent to stream channels.
DMA10 Silver Sagebrush/ Western Porcupine grass – Needle and thread	Ov 1.2.1	For any SLM that has the landscape model I3l, and the dominant or co-dominant [W]PM does not equal L3 or M4, assign 50% of the SLM to DMA10 - Ov; **OR** for all 3-letter SLMs coded as BUT, MKR or ORN, assign 30% of the SLM to DMA10 - Ov; **OR** for all 4-letter SLMs with BU, MK or OR in the code as either the first two or the last two letters (meaning BU, MK or OR are co-dominant), 15% of the SLM is assigned to DMA10 – Ov.	DMA10 occurs with I3l landscape model in the mid- to lower positions, or with the BUT, MKR, or ORN soil series. Usually the 50% non-overflow associated with I3l landscapes is Lo or Cy. The 70% non-overflow component associated with BUT is Lo, while MKR is Li and ORN is SL- 1.13.1.
Complex	WL 1.3.1	Use for all 3-letter SLMs coded as INS, IWT, NDP, SKF, SLY, TEP, VET, WLH, or ZGW; **OR** for any 4-letter SLMs with IN, IW, ND, SK, SL, TE, VE, WL, ZG or ZW in the code as either the first two or the last two letters(indicating co-dominance), 50% of the SLM is WL 1.3.1; **OR** for any 3-	

[2]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
		letter SLM coded as ZWA if the landscape model is not W1, W2 or W3.	
DMA04 Western Wheatgrass – Sandberg Bluegrass	Cy 1.4.1	Use for all 3-letter SLMs coded as MCT, SPS or WDN (now WHN); **OR** use for all 4-letter SLMs with MC, SP or WD (now WH) in the code as either the first two or the last two letters.	Includes weakly expressed Solonetzic (MCT) or Chernozemic soils (SPS or WDN). WDN changed to WHN for this project, to avoid confusion with WDW.
DMA03 Needle and Thread – Thread-leaved Sedge	Lo 1.5.1	Use for all 3-letter SLMs coded as PHN that border the Sweetgrass Hills Land Systems; **OR** use for all SLMs that border the Sweetgrass Hills Land Systems if the landscape model does not equal M1h, M4, R2h, H1h, H5h, or HR2h; **OR**, for all SLMs located in Land Systems that border the Sweetgrass Hills or Milk River Ridge, provided the 3-letter code is MSN, or the 4-letter code contains MS as either the first two or the last two letters.	Acceptable Land System numbers that border the Sweetgrass Hills or Milk River Ridge include 01.1.2a.19c, 01.1.2a.19a, 01.2a.20b, 01.2a.20a, 01.2a.19b, 01.2a.17b, 01.1.12b, 01.1.05c, 01.1.11b, 01.1.11a, 01.1.12a.
DMA02 Needle and Thread – June Grass – Blue Grama	Lo 1.5.2	Use for all 3-letter SLMs coded as MSN or PHN that do not border the Sweetgrass Hills or the Milk River Ridge, and that do not fit in the DMA03-Lo category; **OR** use for all 4-letter SLMs with MS or PH in the code as either the first two or the last two letters, provided the SLMs do not border the Sweetgrass Hills or Milk River Ridge and that do not fit in the DMA03-Lo category; **OR** use for all 3-letter SLMs coded as CCL, CFD, CHN, FMT or MAB, and for all 4-letter SLMs with CC, CF, CH, FM or MA in the code as either the first two or the last two letters, EXCEPT those with soil model numbers 7, 10, 14, 15 or 17.	This is the most extensive Lo range site in the Dry Mixedgrass Natural Subregion.
DMA01 Silver Sagebrush/ Needle and Thread – Blue Grama	Lo 1.5.3	Use for all 3-letter SLMs coded as CHZ (now CIZ), ROL, TIK, or TIY; **OR** use for all 4-letter SLMs with CH (now CI), RO, or TI in the code as either the first two or the last two letters; **OR** use for any 3-letter SLMs coded as CCL, CFD, CHN, FMT or MAB, or for any 4-letter SLMs with CC, CF, CH, FM or MA in the code, PROVIDED the soil model number is 7, 10, 14, 15 or 17; **OR** for any 3-letter SLM coded as BUT, EXCEPT I3l, assign 70% of the SLM to DMA01-Lo; **OR** for any 4-letter SLM with BU in the code, EXCEPT I3l, assign 85% of the SLM to DMA01-Lo.	CHZ changed to CIZ for this project, to avoid confusion with CHN.
DMA06 Silver Sagebrush/ Needle and Thread – Blue Grama	Sy 1.6.1	Use for all 3-letter SLMs coded as ANO, BVL, RAM, RIR or TAB; **OR** use for any 4-letter SLM with AN, BV, RA, RI or TA in the code as either of the first two or the last two letters; **OR** use for landscape models **that do not equal** M1h, M4, R2h, H1h, H5h or HR2h where the 3-letter soil model code is CMY or the 4-letter code contains CM.	Use CMY on low to moderate relief landscape models only. Sy-DMA06 also includes the SwG-RAM soil series.

[2]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
DMA15 not characterized	Li 1.7.1	Use for all 3-letter SLMs coded as ACV, CLR, EXP, HMS or TVS; **OR** use for any 4-letter SLM with AC, CL, EX, HM or TV in the code as either of the first two or the last two letters; **OR** for any 3-letter SLM coded as ORN or MKR, assign 50% of the SLM to DMA15-Li; **OR** for any 4-letter SLM with OR or MK in the code, assign 25% of the SLM to DMA15-Li. **OR** where ZER is not equal to I3l or I3h, I4m or I4h landscape models; **OR** use for the ZUN/I3m SLM.	
DMA07 Silver Sagebrush/ Needle and Thread – Sandgrass	Sa 1.8.1	Use for all 3-letter SLMs coded as CVD, KGO or PLS; **OR** use where any 4-letter SLM has CV, KG or PL in the code as either the first two or the last two letters; **OR** use for any 3-letter SLM coded as VST or any 2-letter SLM with VS in the code, PROVIDED the landscape model does not equal D1m, D2m, D1h or D2h; **OR** for SLMs where the dominant or co-dominant PM equals C0 or C2 AND with the soil model unit #2, 8, 9, 12 or 18, 85% of the SLM is assigned to DMA07-Sa, PROVIDED the landscape model does not equal D1m, D2m, D1h or D2h	For the final rule, the 15% that is not DMA07-Sa is assigned to DMA17-Sb.
DMA13 Northern and Western Wheatgrass	BlO 1.9.1	Use for all 3-letter SLMs coded as RMR, PTA or SIG (now SRG); **OR** use for all 4-letter SLMs with RM, PT or SI (now SR) as either the first two or the last two letters.	SIG changed to SRG for this project to avoid confusion with SIL.
DMA12 Silver Sagebrush/ Northern Wheatgrass – Blue Grama	BlO 1.9.2	Use for all 3-letter SLMs coded as BLP, DHS, GEM, GPH, HDY, HUK, KBD, RHS, RRD, SYK, WDW, YNY or YTW; **OR** use for all 4-letter SLMs with BL, DH, GE, GP, HD, HU, KB, RH, RR, SY, WD, YN or YT in the code as either the first two or the last two letters; **OR** for 3-letter SLMs coded as SIL or 2-letter SLMs with SI in the code, use DMA12-BlO if the landscape model is not any of M1h, M4, R2h, H1h, H5h or HR2h.	The most extensive BlO Range Site in the Dry Mixedgrass Natural Subregion, and covers a range of parent materials from Sa to Lo.
DMA08 Chokecherry/Low sedge – sandgrass	CS 1.10.1	Use for all 3-letter SLMs coded as ATP; **OR** use for all 4-letter SLMs with AT as either the first two or the last two letters; **OR** use for all 3-letter SLMs coded as VST and all 4-letter SLMs with VS in the code, PROVIDED the landscape model equals D1m, D1h, D2m or D2h; **OR** for SLMs where the dominant or co-dominant PM equals C0 or C2 AND with the soil model unit #2, 8, 9, 12 or 18, 85% is assigned to DMA08-CS, PROVIDED the landscape model equals D1m, D1h, D2m or D2h.	Correlates to ATP (Orthic Regosolic) or VST (Rego Chernozemic); the latter only on duned moderate to high relief landscapes.
DMA14 Northern	TB 1.11.1	Use for all SLMs using I3m or I3h landscape models; **OR** for all 3-letter SLMs coded as PHN, CMY or SIL, and for all 4-letter SLMs with PH, CM or SI as	-----

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
Wheatgrass – June grass - Sedge		either the first two or the last two letters, PROVIDED the landscape model is any of M1h, M4, R2h, H1h, H5h, or HR2h.	
DMA11 Silver Sagebrush / Western Wheatgrass	SL 1.13.1	For all 3-letter SLMs coded as MKR or ORN, assign 20% to DMA11-SL; **OR** for all 4-letter SLMs with MK or OR as either the first two or the last two letters, assign 10% to DMA11-SL.	Approximately 30 to 50% bare soil with dwarf Silver Sagebrush on sodic lowlands and lower reaches of aprons and fans (particularly in Pakowki Basin).
DMA09 Silver Sagebrush/ Wheatgrass	SL 1.13.2	Use for all 3-letter SLMs coded as MCN (now MNB) or WTNaa; **OR** use for all 4-letter SLMs with MC (now MN) or WT as either the first two or the last two letters.	MCN changed to MNB for this project to avoid confusion with MCT. Approximately 75% bare soil with decimeter high Silver Sagebrush usually on saline and sodic soils.
DMA18 not characterized	SL 1.13.3	Use for all 3-letter SLMs coded as DHP (now DSP), GLS, KTM, LYB, SFD or ZNA; **OR** use for all 4-letter SLMs with DH (now DS), GL, KT, LY, SF or ZN as either the first two or the last two letters.	DHP changed to DSP for this project to avoid confusion with DHS. Dominantly bare soil in isolated depressions (evaporative flats); with saline Gleysolic or saline Gleyed soils.
DMA05 Silver Sagebrush/ Needle and Thread – Fringed Sage	Gr 1.14.1	Use for all 3-letter SLMs coded as EZM, or PUN; **OR** use for all 4-letter SLMs with EZ, or PU as either the first two or the last two letters.	
DMA16 Thread-leaved Sedge – Moss Phlox	BdL 1.15.1	Use for all SLMs where: **the** 3-letter code equals ZCV; **OR** where the 4-letter code has ZC as either the first two or the last two letters; **OR** for any SLM with the landscape model I4m, I4h or I5.	Badlands are usually areas with >10% exposed Cretaceous softrock.
----------	[Y]Urb 1.16.1	Use for disturbed land (DL) landscape model.	Cities, towns or disturbed land. The soil model is usually ZUN (undifferentiated).

[Z]Ecological range sites are arranged in order from most productive to least productive to facilitate the identification of the most limiting ecological range site and plant community for co-dominant soil models.
[Y]Indicates an ecological range site that has been added for the purposes of this project.
[X]Soil Landscape Model. [W]Parent material in the master file of AGRASID

Reference Plant Communities of SCA2 (Mixed Grass Natural Subregion – Milk River Ridge / Sweet Grass Hills / Cypress Hills) as Related By Ecological Range Site – Soil Landscape Model Correlations Rule Building, LandWise Inc.

Soil Landscape Models (SLMs) are indicated as soil series unit number/landscape model (e.g. MAB10/U1h). Three-letter soil series codes indicate that one soil series is dominant (e.g., Maleb = MAB). SLMs with four-letter soil series codes indicate two co-dominant soil series that are represented by the first two and the last two letters (e.g., Maleb-Cranford = MACF). Unit numbers range from 1 to 22 (10 in the above example), and represent a particular assemblage of significant soils. The landscape model indicates surface form, relief and slope characteristics. Refer to AGRASID 3.0 for further details (ASIC 2001).

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
----------	[Y]Wa 2.0.0	Use for the undifferentiated soil model ZWA only if associated with a water-dominated landscape model (W1, W2, or W3).	Any permanent body of water; (e.g., lakes, reservoirs and rivers).
------	Sb	No occurrences in SCA2 after running rules (for rules see SCA1).	
Complex	[Y]Ri 2.1.5	Use for landscape models of stream channel or floodplain (SC1-l, SC1-h, SC2, SC3, SC4, FP1, FP2, or FP3).	The zone most closely adjacent to stream channels.
MGC03 Snowberry – Green Needle grass	Ov 2.2.1	For any [X]SLM that has the landscape model I3l, and the dominant or co-dominant [W]PM does not equal L3 or M4, assign 50% of the SLM to MGC03 and Ov; **OR** for landscape models H1m, H1h, HR2m, or HR2h, and where the dominant or co-dominant PM equals MO, M2, M3, M4, M6, L3, L10 or L15, 15% of the SLM (lower slope portions) is MGC03 and Ov.	MGC03 occurs in moist swales of hummocky landscapes, or on mid and lower inclined slopes, often with GNN soils. The non-overflow components of 50% or 85% are usually assigned to Lo.
Complex	WL 2.3.1	Use for all 3-letter SLMs coded as ZGW; **OR** for any 4-letter SLMs with ZG or ZW in the code as either the first two or the last two letters (indicating co-dominance), 50% of the SLM is WL 2.3.1; **OR** use for any 3-letter SLM coded as ZWA if the landscape model is not W1, W2 or W3.	Very limited WL ha in SCA2.
MGA26 not characterized	Cy 2.4.1	Use for all SLMs where the dominant or co-dominant PM equals any of F0, F1, F2, F3, F4 or L22; **OR** use for any 3-letter SLMs coded as HEG or RLK; **OR** use for any 4-letter SLM with HE or RL in the code as either the first two or the last two letters.	
MGA01 Rough fescue –	Lo1-CH 2.5.1	Confined to the **Cypress Hills Region** in Land Systems that border and include the Cypress Hills Escarpment and Plateau. These land systems are specifically	Includes high-elevation Dark Brown and Black soils. Includes shallow-to-

Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
Porcupine Grass – Sedge		denoted as Ls sym in AGRASID, and include 03.00.01, 03.0a.10, 03.0a.11, 03, 0a.14, 03.0a.15, and 03.0b.08. Within the identified area, use for all SLMs where the dominant or co-dominant PM equals MO, M1, M2, M3, M4, M6, L3, L4, L5, L10, and L15; **Or** use for any 3-letter SLM coded as EKW, MMD, PME, THA, or WSM; **OR** use for any 4-letter SLM with DM, EK, MM, PM, RS, TH or WS in the code as either the first two or the last two letters;	gravel and limy range sites, as this plant community has low evapotranspiration and is seldom limited by aridity. Includes DM and RS, but only as co-dominant (DMS and RSR are Gr).
MGA04 Needle and Thread – Northern Wheatgrass – June Grass	Lo2-CH 2.5.2	Confined to the **Cypress Hills Region** in Land Systems that border the Wildhorse and Schuler Plains. These land systems are specifically denoted as Ls sym in AGRASID. Within the identified area, use for all SLMs where the dominant or co-dominant PM equals MO, M2, M3, M4, M6, L3, L10 or L15; **OR** use for any 3-letter SLM coded as TTH or GNN; **OR** use for any 4-letter SLM with TT or GN in the code as either the first two or the last two letters.	Confined to Land Systems 03.0a.01a, 03.oa.01b, 03.0a.04a, 03.0a.04b, and 03.0b.06.
MGA12 Idaho Fescue – Northern Wheatgrass – Needle and Thread	Lo1-MRR 2.5.1	Use for the mid- to high-elevation regions (1100-1280 m, avg 1200m) in Land Systems of the **Milk River Ridge and Sweetgrass Hills** (Ls sym in AGRASID). Within the identified area, use for all SLMs where the dominant or co-dominant PM equals MO, M2, M3, M4, M6, L3, L10 or L15; **OR** use for any 3-letter SLM coded as PUR or SOL; **OR** use for any 4-letter SLM with PU or SO in the code as either the first two or the last two letters; **OR** use for SLMs with a significant portion of Solonetzic soils, 80% of the SLM area is assigned to MGA01. SLMs with a significant portion of Solonetzic soils are identified by the unit numbers 7, 10, 14, 15, and 17.	MGA12 corresponds to medium textures (L – CL – SiCL). Confined to Land Systems 04.1b.01a, 02.5.07b, 02.5.08, and 02.5.02. This only includes PUR in the identified land systems, and the provincial Digital Elevation Model was used to isolate the elevation range of 1100 to 1280 m.
MGA15 Needle and Thread – Northern Wheatgrass – June Grass	Lo2-MRR 2.5.2	Use for the lower elevation regions (1050 –1200 m, avg 1100m) in Land Systems (Ls sym in AGRASID) of the **Milk River Ridge and Sweetgrass Hills**. Within the identified area, use for all soil landscape models where the dominant or co-dominant PM equals MO, M2, M3, M4, M6, L3, L10 or L15; **OR** use for 3-letter SLMs coded as FOR, LUP, MGA, PLP or PUR; **OR** use for 2-letter SLMs with FO, LU, MG, PL or PU in the code as either the first two or the last two letters; **OR** use for SLMs with a significant portion of Solonetzic soils, 80% of the SLM area is assigned to MGA01. SLMs with a significant portion of Solonetzic soils are identified by the unit numbers 7, 10, 14, 15, and 17.	MGA15 corresponds to loam, clay loam, and occasionally to sandy loam textures. Confined to Land Systems 02.5.07a, 02.5.04a,c,d,e,f,g, 02.5.03a, and 02.5.03b. For the last rule, the 20% that is non-Lo is assigned to MGA19-BlO-MRR-2.9.1.
MGA18 Needle and Thread – Northern	Sy, Sa 2.6.9	Use for all SLMs where the dominant or co-dominant PM equals C0, C2, C3, C4, C5, L2, L9, L18, L20 or L21, and the regional soil choice equals Black Chernozemic; **OR** use for 3-letter SLMs coded as HRK, KSRaa, LVYaa, or	Sy and Sa are combined based on site characterizations by Alberta Public Lands

[2]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
Wheatgrass – Sand reed grass		MKRaa; **OR** use for 2-letter SLMs with HR, KS, LV, or MK in the code as either the first two or the last two letters.	
MGA25 Wheatgrass – Prairie Muhly	Li 2.7.1	Use for all 3-letter SLMs coded as WCR or WID; **OR** use for any 4-letter SLM with WC or WI in the code as either of the first two or the last two letters; **OR** where ZER is not equal to I3l or I3h, I4m or I4h landscape models. **OR** use for the ZUN/I3m SLM.	ZER is associated with the limy range site on I3m or non-inclined landscape models, and also with ZUN/I3m. The high-elevation limy Cypress Hills soil (PME) is Lo- MGA01.
MGA07 Needle and Thread – Fescue - Western Wheatgrass	BlO-CH 2.9.2	Use for all SLMs in the **Cypress Hills Region** where: **the** regional soil choice equals Solonetzic; **OR** where any 3-letter SLM is coded as CGW, MCA, MHR, or MNA; **OR** where any 4-letter SLM has CG, MC, MH, or MN in the code as either the first two or the last two letters.	------
MGA19 Wheatgrasses	BlO-MRR 2.9.2	Use for all SLMs in the **Milk River Ridge area** (Ecodistrict 02.5) where: **the** regional soil choice equals Solonetzic; **OR** where any 3-letter SLM is coded as GRG or MNA; **OR** where any 4-letter SLM has GR or MN in the code as either the first two or the last two letters; **OR,** for SLMs with a significant portion of Solonetzic soils, 20% of the SLM area will be assigned to MGA19. SLMs with a significant portion of Solonetzic soils are identified by the unit numbers 7, 10, 14, 15, and 17. (Unit numbers follow the 3- or 4-letter coded soil model).	The 80% non-BlO portion of Rule 4 would usually be assigned to loamy MGA12 or MGA15, based on elevation.
	CS	No occurrences in SCA2 after running rules (for rules see SCA1).	
MGA17 Northern Wheatgrass – Needle and Thread – June grass	TB-MRR 2.11.1	Use for all SLMs in the **Milk River Ridge area** (Ecodistrict 02.5) where: the dominant or co-dominant PM equals C6, C7, M5, F5, F6, L6, L7, L8, or L16; **OR** for SLM's using I3h or I4m landscape models.	No occurrences in AGRASID 3.0, but plant community has been sampled at least 7 times. Therefore, the occurrences may be site specific, or there may be errors in AGRASID 3.0.
MGA05 Silver sagebrush/ Northern Wheatgrass – June grass	TB-CH 2.11.1	Use for all soil landscape models in the **Cypress Hills Region** (Ecoregion 03) where: the dominant or codominant PM equals any of C6, C7, M5, F5, F6, L6, L7, L8, or L16; **OR** where the 3-letter coded soil models equals DPT; **OR** where the 4-letter coded soil model (co-dominant) has DP in the soil model descriptor (either of the first two or the last two letters); **OR** SLM's using I3h or I4m landscape models.	------
MGA27 not characterized	SwG 2.12.1	Use for all SLMs where the dominant or co-dominant PM equals M1 but not in Land Systems bordering the Cypress Hills Plateau or Escarpment. The excluded land systems are specifically denoted as Ls sym in AGRASID, and include 03.00.01, 03.0a.10, 03.0a.11, 03.0a.15, and 03.0b.08.	Only 0.02% of the area of SCA2 is MGA27 – SwG.

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
MGA21 Salt grass – Western Wheatgrass	SL 2.13.2	Use for all SLMs where: the 3-letter code equals ZNA; **OR** where the 4-letter code has ZN as either the first two or the last two letters.	No occurrences in AGRASID 3.0, but there may be errors in AGRASID, or there may be site-specific occurrences.
MGA27 not characterized	Gr 2.14.1	Use for all soil landscape models where the codominant or dominant PM equals any of C1, L1, or L14; **OR** use for any 3-letter SLM coded as DMS, NEDaa, or RSR. (DM and RS are Lo1-CH – 2.5.1. NEaa does not occur in SCA2.	PC's will be unique to each soil series. E.g., DMS represents the Cypress Hills Grassland, and RSR represents Lodgepole Pine.
To Be Determined	BdL 2.15.1	Use for all SLMs where: **the** 3-letter code equals ZCV; **OR** where the 4-letter code has ZC as either the first two or the last two letters; **OR** for any SLM with landscape model I4h or I5.	Badlands are usually areas with >10% exposed Cretaceous softrock.
----------	[Y]Urb 2.16.1	Use for disturbed land (DL) landscape model.	Cities, towns or disturbed land. The soil model is usually ZUN (undifferentiated).

[Z]Ecological range sites are arranged in order from most productive to least productive to facilitate the identification of the most limiting ecological range site and plant community for co-dominant soil models.
[Y]Indicates an ecological range site that has been added for the purposes of this project.
[X]Soil Landscape Model. [W]Parent material in the master file of AGRASID

Reference Plant Communities of SCA3 (Mixed Grass Natural Subregion – Dark Brown Southern Alberta Plains) as Related By Ecological Range Site – Soil Landscape Model Correlations
Rule Building, LandWise Inc.

Soil Landscape Models (SLMs) are indicated as soil series unit number/landscape model (e.g. MAB10/U1h). Three-letter soil series codes indicate that one soil series is dominant (e.g., Maleb = MAB). SLMs with four-letter soil series codes indicate two co-dominant soil series that are represented by the first two and the last two letters (e.g., Maleb-Cranford = MACF). Unit numbers range from 1 to 22 (10 in the above example), and represent a particular assemblage of significant soils. The landscape model indicates surface form, relief and slope characteristics. Refer to AGRASID 3.0 for further details (ASIC 2001).

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
----------	[Y]Wa 3.0.0	Use for the undifferentiated soil model ZWA only if associated with a water-dominated landscape model (W1, W2, or W3).	Any permanent body of water; (e.g., lakes, reservoirs and rivers).
------	Sb	No occurrences in SCA3 after running rules (for rules see SCA1).	
Complex	[Y]Ri 3.1.5	Use for landscape models of stream channel or floodplain (SC1-l, SC1-h, SC2, SC3, SC4, FP1, FP2, or FP3).	The zone most closely adjacent to stream channels.
MGC03 Snowberry – Green needle grass	Ov 3.2.1	For any [X]SLM coded as I3l where the dominant or co-dominant [W]PM does not equal L3 or M4, 50% of the SLM is MGC03 and Ov.	This rule commonly applies to ZUN or ZER soil models. The 50% non-overflow portion is usually assigned to loamy range sites.
------	WL 3.3.1	Use for all SLMs where: the 3-letter code equals MNH, SGY or ZGW; **OR** for any 4-letter SLM with MN, SG, ZG or ZW in the code as either the first two or the last two letters (indicating co-dominance), 50% of the SLM is WL 3.3.1; **OR** use for any 3-letter SLM coded as ZWA if the landscape model is not W1, W2 or W3.	
MGA22 Wheatgrass – Needle and Thread	Lo, Cy 3.4.9	Use for all SLMs where the dominant or co-dominant PM equals any of F0, F1, F2, F3, F4, M0, M2, M3, M4, L3, L4, L5, L10, L15 or L22 **EXCEPT** for those identified in MGA15-Lo; **OR** use for any 3-letter SLM coded as CLD, FSTaa, CRD, KCH, LET, MGT, OAS, PGT, PUY, RDM, or WNY; **OR** use for any 4-letter SLM with CL, FS, CR, KC, LE, MG ,OA, PG, PU, RD, or WN in the code as either the first two or the last two letters; **OR** for SLMs with a significant portion of Solonetzic soils, 80% of the SLM area will be assigned to	MGA22 – Lo, Cy includes both Lo and Cy sites in SCA3, because Wheatgrass – Needle and Thread plant community overlaps both Cy and Lo sites in SCA3.

[2]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
		MGA22. SLMs with a significant portion of Solonetzic soils are identified by the unit numbers 7, 10, 14, 15, and 17.	
MGA15 Needle and Thread – Northern Wheatgrass – June Grass	Lo 3.5.2	Use for the elevation range of 1050 –1200 m (avg 1100m) in the Dark Brown plains **bordering the Milk River Ridge** in the following Land Systems (Ls sym in AGRASID): 02.5.07a, 02.5.04a,c,d,e,f,g, 02.5.03a, and 02.5.03b, and where the dominant or co-dominant PM equals MO, M2, M3, M4, M6, L3, L10 or L15. Within the identified area, use where the 3-letter SLM is coded as FOR, LUP, MGA, PLP or PUR; **OR** where the 4-letter SLM contains FO, LU, MG, PL or PU in the code as either the first two or the last two letters.	MGA15 corresponds to loam and occasionally to sandy loam textures.
MGA18 Needle and Thread – Northern Wheatgrass – Sand reed grass	Sy, Sa 3.6.9	Use for all SLMs where the dominant or co-dominant PM equals C0, C2, C3, C4, C5, L2, L9, L18, L20 or L21, and the regional soil choice equals Black Chernozemic; **OR** use for any 3-letter SLM coded as KSR, CMY, MGRaa or HRKaa; **OR** use for any 4-letter SLM with KS, CM, MG or HR in the code as either the first two or the last two letters.	MGA18 – Sy, Sa is dominated by Sy soils, but includes significant Sa. Sa may more suitably fit with MGA30 – CS, but this requires further investigation.
MGA25 Wheatgrasses – Prairie Muhly	Li 3.7.1	Use for all 3-letter SLMs coded as BKE, CIO, DIM, MCNaa (now MNBaa), NEM, OSN, SXT, VEB, or WLG; **OR** use for any 4-letter SLM with BK, CI, DI, MC (now MN), NE, OS, SX, VE or WL in the code as either of the first two or the last two letters; **OR** where ZER is not equal to I3l or I3h, I4m or I4h landscape models; **OR** use for the ZUN/I3m SLM.	MCNaa changed to MNBaa for this project to avoid confusion with MCT. ZER is usually associated with the limy range site on I3m or non-inclined landscape models.
MGA29 not characterized	BlO 3.9.2	Use for all 3-letter SLMs coded as AWD, BFDaa, IMY, KHO, KRK, LSD, PAR, or ZSZ; **OR** use for any 4-letter SLM with AW, BF, IM, KH, KR, LS, PA or ZS in the code as either of the first two or the last two letters; **OR** for SLMs with a significant portion of Solonetzic soils, 20% of the SLM area will be assigned to MGA29. SLMs with a significant portion of Solonetzic soils are identified by the unit numbers 7, 10, 14, 15, and 17.	The 80% non-Solonetzic portion of SLMs identified by unit numbers 7, 10, 14, 15 and 17 are mostly assigned to Lo- MGA 22.
MGA30 not characterized	CS 3.10.1	Use for all SLMs where the dominant or co-dominant PM equals C0, C2, C4, or L2, and the landscape model equals any of D1l, D2l, D1m, D2m, D1h or D2h.	Correlates to duned landscape models in SCA3.
MGA28 not characterized	TB 3.11.1	Use for all soil landscape models where: the dominant or codominant PM equals any of C6, C7, M5, F5, F6, L6, L7, L8, or L16; **OR** where the 3-letter coded soil models equals MKN, VAC, or TLAaa; **OR** where the 4-letter coded soil model (co-dominant) has MK, TL, or VA in the soil model descriptor (either of the first two or the last two letters); **OR** SLM's using I3m, I3h or I4m landscape models.	------
MGA31	SwG, Gr	Use for all SLMs where the dominant or co-dominant PM equals C1, L1, L4,	NED changed to NDA for this project to

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
not characterized	3.12.5	L5, L14, or M1; **OR** for any 3-letter SLMs coded as CFT, MAC, NED (now NDA), or WOL; **OR** for any 4-letter SLM with CF, MA, NE (now ND) or WO in the code as either the first two or the last two letters.	avoid confusion with NEM.
MGA21 Salt grass – Western Wheatgrass	SL 3.13.2	Use for all SLMs where: the 3-letter code equals ZNA, HSR, KCP (now KYS), LLD or WTN; **OR** where the 4-letter code has ZN, HS, KC (now KY), LL or WT as either the first two or the last two letters.	KCP changed to KYS for this project to avoid confusion with KCH.
-------	BdL 3.15.1	Use for any SLM with landscape model I4h or I5.	Badlands are usually areas with >10% exposed Cretaceous softrock.
----------	[Y]Urb 3.16.1	Use for disturbed land (DL) landscape model.	Cities, towns or disturbed land. The soil model is usually ZUN (undifferentiated).

[Z]Ecological range sites are arranged in order from most productive to least productive to facilitate the identification of the most limiting ecological range site and plant community for co-dominant soil models.
[Y]Indicates an ecological range site that has been added for the purposes of this project.
[X]Soil Landscape Model. [W]Parent material in the master file of AGRASID

Reference Plant Communities of SCA4 (Northern Fescue – Dark Brown of East-Central Alberta)) as Related By Ecological Range Site – Soil Landscape Model Correlations Rule Building, LandWise Inc.

Soil Landscape Models (SLMs) are indicated as soil series unit number/landscape model (e.g. MAB10/U1h). Three-letter soil series codes indicate that one soil series is dominant (e.g., Maleb = MAB). SLMs with four-letter soil series codes indicate two co-dominant soil series that are represented by the first two and the last two letters (e.g., Maleb-Cranford = MACF). Unit numbers range from 1 to 22 (10 in the above example), and represent a particular assemblage of significant soils. The landscape model indicates surface form, relief and slope characteristics. Refer to AGRASID 3.0 for further details (ASIC 2001).

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
----------	[Y]Wa 4.0.0	Use for the undifferentiated soil model ZWA only if associated with a water-dominated landscape model (W1, W2, or W3).	Any permanent body of water; (e.g., lakes, reservoirs and rivers).
------	Sb	No occurrences in SCA4 after running rules (for rules see SCA1).	
Complex	[Y]Ri 4.1.5	Use for landscape models of stream channel or floodplain (SC1-l, SC1-h, SC2, SC3, SC4, FP1, FP2, or FP3).	The zone most closely adjacent to stream channels.
NFA14 Snowberry / Green Needlegrass	Ov 4.2.1	For any [X]SLM that has the landscape model I3l, and the dominant or co-dominant [W]PM does not equal L3 or M4, assign 50% of the SLM to NFA14 and Ov; **OR** for landscape models H1m, H1h, HR2m, or HR2h, and where the dominant or co-dominant PM equals MO, M2, M3, M4, M6, L3, L10 or L15, 15% of the SLM (lower slope portions) is NFA14 and Ov; **OR** for all 3-letter SLMs coded as BKF, 20% of the SLM is NFA14 and Ov; **OR** for all 4-letter SLMs with BK in the code as either the first two or the last two letters (meaning BK is co-dominant), 10% of the SLM is NFA14 and Ov.	NFA14 occurs with: I3l landscape model in mid- to lower positions, the BKF soil series, or moist swales of hummocky lands. The 50% non-overflow associated with I3l landscapes is usually Lo or Cy. The 80 and 90% non-overflow components with BKF are SL, and the 85% non-overflow associated with hummocky landscapes is Lo.
------	WL 4.3.1	Use for all SLMs where the 3-letter code equals FBG, FLT, FMNaa, THR, ZGW; **OR** for any 4-letter SLM with FB, FL, FM, TH, ZG, or ZW in the code as either the first two or the last two letters (indicating co-dominance), 50% of the SLM is WL 4.3.1; **OR** use for any 3-letter SLM coded as ZWA if the landscape model is not W1, W2 or W3.	
NFA19 Western Wheatgrass	Cy 4.4.1	Use for all SLMs where the dominant or co-dominant PM equals any of F0, F1, F2, F3, F4 or L22; **OR** use for any 3-letter SLM coded as DMH; **OR** use for any 4-letter SLM with DM in the code as either the first two or the last two letters.	

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
NFA22 Rough fescue – Western Porcupine Grass	Lo 4.5.1	Confined to the portion of the Hand Hills Land Systems that are in the Black soil zone (02.2b.03,02.2b.04a, 02.2b.04b, 02.2b.08). Use for all SLMs where the dominant or co-dominant PM equals MO, M2, M3, M4, M6, L3, L10 or L15; **OR** use for any 3-letter SLM coded as HAN or THB; **OR** use for any 4-letter SLM with HA or TH in the code as either the first two or the last two letters.	The identified plant community is similar to FFA23 in SCA6 (Foothills Fescue North with Black soils).
NFA01 Rough fescue – Needle and Thread	Lo 4.5.2	Use for all SLMs where the dominant or co-dominant PM equals MO, M2, M3, M4, M6, L3, L10 or L15; **OR** use for any 3-letter SLM coded as ALT, CNN, FST, HND, KUR, LFE, MTR, NUT, OVE, or PRO; **OR** use for any 4-letter SLM with CN, FS, HN, KU, LF, MT, NU, OV, or PR in the code as either the first two or the last two letters. For the above three rules, **Do not use for** SLMs with significant coarse textures (model numbers 6, 9, 11, 12, 15) and **Do not use for** the Black soil Hand Hills Land Systems.	The Limy soil series ALT, NUT, and MTR are all included in Lo 4.5.2, as site characterizations of Li soils indicate the plant community is not unique.
NFA04 Rough fescue – Sedge – June grass	Lo 4.5.3	Use for all SLMs where the dominant or co-dominant PM equals MO, M2, M3, M4, M6, L3, L10, L15, or L18; OR use for any 3- or 4-letter SLM with DCY or DC in the code; **OR** use for any 3-letter SLM coded as CNN, FST, HND, KUR, LFE, OVE, PRO, ALT, NUT, or MTR, **BUT ONLY** for those SLMs with significant coarse textures (soil model numbers 6, 9, 11, 12, 15); **OR** use for any 4-letter SLM with CN, FS, HN, KU, LF, OV, PR, AL, NU, or MT in the code as either the first two or the last two letters, **BUT ONLY** for those SLMs with significant coarse textures (soil model numbers 6, 9, 11, 12, 15). **Do not use for** the portion of Hand Hills Land Systems that are in the Black soil zone.	NFA04 is typified by medium- to moderately-coarse-textured soils, while NFA01 is typified by medium-textured soils.
NFA16 Upland Sedge – Sand grass	Sy, Sa 4.6.9	Use for all SLMs where the dominant or co-dominant PM equals C0, C2, C3, C4, C5, L2, L9, L20 or L21, and the regional soil choice equals Black Chernozemic; **OR** use for any 3-letter SLM coded as HCH, MET, RIB, or WWT; **OR** use for any 4-letter SLM with HC, ME, RI or WW in the code as either the first two or the last two letters.	
-------	Li	----------	Included with Lo range sites.
NFA18 Western Wheatgrass – Blue grass	BlO 4.9.1	Use for all SLMs where any 3-letter SLM is coded as MIC, VTR, or WES; **OR** for any 4-letter SLM with MI, VT, or WE in the code as either the first two or the last two letters.	Correlates to moderately-fine textured lacustrine Solodized Solonetz (WES), Solonetz (VTR), or very-fine textured Solod (MIC).
NFA07 Rough fescue –	BlO 4.9.2	Use for all SLMs where any 3-letter SLM is coded as BFD, CUR, FNR, HKR, LHD, or SUL; **OR** for any 4-letter SLM with BF, CU, FN, HK, LH or SU in the	All dominant or co-dominant Solonetzic SLMs except glaciolacustrine

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
Sedge – Wheatgrass		code as either the first two or the last two letters.	moderately-fine- to very-fine-textured soils.
NFA17 Juniper / Sand grass –Rough fescue	CS 4.10.1	Use for all SLMs where the dominant or co-dominant PM equals C0, C2, C4, or L2, and the landscape model equals any of D1l, D2l, D1m, D2m, D1h or D2h; **OR** use for any 3-letter SLM coded as ERT; **OR** use for any 4-letter SLM with ER in the code as either the first two or the last two letters.	NFA17 is associated with the ERT soil on any landscape. If the soil series does not include ERT or ER, then the landscape must be duned.
NFA15 Needle and Thread – Sedge	TB 4.11.1	Use for all SLMs where the co-dominant or dominant PM equals C6, C7, M5, F5, F6, L6, L7, L8, or L16; **OR** for any 3-letter SLM coded as DLA, PTE, SHR or TLA; **OR** for any 4-letter SLM with DL, PT, SH or TL in the code as either the first two or the last two letters; **OR** 50% of the SLM ZUN1/I3l; **OR** use for all SLM's with I3h or I4m landscape models.	For the final rule, the remaining 50% of the SLM ZUN1/I3l is assigned to Ov-NFA14.
--------	SwG	No occurrences in SCA4 after running rules. (For rules see SCA5).	
NFA20 Salt grass – Western Wheatgrass	SL 4.13.2	Use for all SLMs where: the 3-letter code equals GLK or ZNA; **OR** where the 4-letter code has GL or ZN as either the first two or the last two letters; **OR** The 80% non-overflow component associated with any 3-letter SLM coded as BKF is SL, **OR** for any 4-letter SLM with BK in the code as either the first two or the last two letters, 70% of the SLM will be NFA20-SL.	The 20% or 30% non-SL component of BKF is Ov.
NFA21 not characterized	Gr 4.14.1	Use for all soil landscape models where the codominant or dominant PM equals any of C1, L1, L14 or M1 ; **OR** use for any 3-letter SLM coded as SCD; **OR** use for any 4-letter SLM with SC in the code as either the first two or the last two letters.	
-------	BdL 4.15.1	Use for all SLMs with either the landscape model I4h or I5.	Badlands are usually areas with >10% exposed Cretaceous softrock.
----------	[Y]Urb 4.16.1	Use for disturbed land (DL) landscape model.	Cities, towns or disturbed land. The soil model is usually ZUN (undifferentiated).

[Z]Ecological range sites are arranged in order from most productive to least productive to facilitate the identification of the most limiting ecological range site and plant community for co-dominant soil models.
[Y]Indicates an ecological range site that has been added for the purposes of this project.
[X]Soil Landscape Model. [W]Parent material in the master file of AGRASID

Reference Plant Communities of SCA5 (Foothills Fescue Natural Subregion - South) as Related By Ecological Range Site – Soil Landscape Model Correlations Rule Building, LandWise Inc.

Soil Landscape Models (SLMs) are indicated as soil series unit number/landscape model (e.g. MAB10/U1h). Three-letter soil series codes indicate that one soil series is dominant (e.g., Maleb = MAB). SLMs with four-letter soil series codes indicate two co-dominant soil series that are represented by the first two and the last two letters (e.g., Maleb-Cranford = MACF). Unit numbers range from 1 to 22 (10 in the above example), and represent a particular assemblage of significant soils. The landscape model indicates surface form, relief and slope characteristics. Refer to AGRASID 3.0 for further details (ASIC 2001).

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
----------	[Y]Wa 5.0.0	Use for the undifferentiated soil model ZWA only if associated with a water-dominated landscape model (W1, W2, or W3).	Any permanent body of water; (e.g., lakes, reservoirs and rivers).
------	Sb	No occurrences in SCA5 after running rules (for rules see SCA1).	
Complex	[Y]Ri 5.1.5	Use for landscape models of stream channel or floodplain (SC1-l, SC1-h, SC2, SC3, SC4, FP1, FP2, or FP3).	The zone most closely adjacent to stream channels.
FFA01 Rough fescue – Idaho fescue – Western Wheatgrass	Ov 5.2.1	For all 3-letter [X]SLMs coded as HLM, 20% of the SLM is FFA01 and Ov; **OR** for all 4-letter SLMs with HL in the code as either the first two or the last two letters (meaning HL is co-dominant), 10% of the SLM is FFA01 and Ov; **OR** for any SLM (except HLM) coded as I3l where the dominant or co-dominant [W]PM does not equal L3 or M4, 50% of the SLM is FFA01 and Ov.	Overflow occurs only on lower slopes. The non-overflow portion is usually assigned to loamy, clayey or limy range sites. The final rule commonly applies to ZUN or ZER soil models.
------	WL 5.3.1	Use for all SLMs where the 3-letter code equals JAT or ZGW; **OR** for any 4-letter SLM with JA, ZG, or ZW in the code as either the first two or the last two letters (indicating co-dominance), 50% of the SLM is WL 5.3.1; **OR** use for any 3-letter SLM coded as ZWA if the landscape model is not W1, W2 or W3.	
FFA21 Western Wheatgrass	Cy 5.4.1	Use for all SLMs where the co-dominant or dominant [X]PM equals F0, F1, F2, F3, F4 or L22; **OR** use for any 3-letter SLM coded as CTN or PNR; **OR** use for any 4-letter SLM with CT or PN in the code as either the first two or the last two letters.	
FFA02 Rough fescue – Idaho fescue –	Lo 5.5.2	Use for all soil landscape models where the co-dominant or dominant PM equals MO, M2, M3, M4, M6, L3, L10, L15, or L18;**OR** use for any 3-letter SLM coded as BZR, BUL, DLB, SAK or SOF; **OR** use for any 4-letter SLM	

[2]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
Sedge		with BZ, BU, DL, SA or SO in the code as either the first two or the last two letters; **OR** for any 3-letter SLM coded as HLM, EXCEPT I3l, assign 80% of the SLM to FFA02-Lo; **OR** for any 4-letter SLM with HL in the code, EXCEPT I3l, assign 90% of the SLM to FFA02-Lo.	
FFA22 Rough fescue – Western Porcupine Grass	Sy 5.6.1	Use for all soil landscape models where the co-dominant or dominant PM equals C3, C5, L9, L20 or L21; **OR** use for any 3-letter SLM coded as KNT or LVY; **OR** use for any 4-letter SLM with KN or LV in the code as either the first two or the last two letters.	
FFA19 Western Wheatgrass – Little Bluestem	Li 5.7.1	Use for all 3-letter SLMs coded as CWY, ODM, or PSO; **OR** for any 4-letter SLM with CW, OD, or PS in the code as either the first two or the last two letters; **OR** where ZER or ZE do not occur with I3l, I3h, I4m or I4h landscape models; **OR** use for the ZUN/I3m SLM.	ZER is associated with the limy range site on I3m or non-inclined landscape models, and also with ZUN/I3m.
	Sa	No occurrences in SCA5 after running rules (for rules see SCA6).	
FFA20 Rough fescue – Western Wheatgrass	BlO 5.9.2	Use for all SLMs where the regional soil choice equals Solonetzic; **OR** for any 3-letter SLM coded as CGE, KGT, MAM, NNK, or PGN; **OR** for any 4-letter SLM with CG, KG, MA, NN, or PG in the code as either the first two or the last two letters.	------
------	CS	No occurrences in SCA5 after running rules (for rules see SCA6).	
FFA17 Rough fescue – Parry Oatgrass – June grass	TB 5.11.1	Use for all SLMs where the co-dominant or dominant PM equals C6, C7, M5, F5, F6, L6, L7, L8, or L16; **OR** for any 3-letter SLM coded as MKN, NFK, OKY, OWD, OXY or SND; **OR** for any 4-letter SLM with MK, NF, OK, OW, OX, or SN in the code as either the first two or the last two letters; **OR** all SLM's with I3h or I4m landscape models.	The last rule generally applies to ZUN or ZER soil models.
FFA09 Rough fescue – Parry Oatgrass	SwG 5.12.1	Use for all SLMs where the dominant or co-dominant PM equals M1, L4 or L5; **OR** for any 3-letter SLMs coded as BFT or RFD; **OR** for any 4-letter SLM with BF or RF in the code as either the first two or the last two letters.	------
------	SL	No occurrences in SCA5 after running rules (for rules see SCA4).	
FFA13 Rough fescue – Idaho fescue – June grass	Gr 5.14.1	Use for all SLMs where the dominant or co-dominant PM equals C1, L1, or L14; **OR** for any 3-letter SLM coded as RND; **OR** for any 4-letter SLM with RN as the first two or the last two letters.	------
------	BdL 5.15.1	Use with all SLMs using landscape model I4h or I5.	Minor ha of BdL in SCA5.

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
----------	[Y]Urb 5.16.1	Use for disturbed land (DL) landscape model.	Cities, towns or disturbed land. The soil model is usually ZUN (undifferentiated).

[Z]Ecological range sites are arranged in order from most productive to least productive to facilitate the identification of the most limiting ecological range site and plant community for co-dominant soil models.

[Y]Indicates an ecological range site that has been added for the purposes of this project.

[X]Soil Landscape Model. [W]Parent material in the master file of AGRASID

Reference Plant Communities of SCA6 (Foothills Fescue Natural Subregion – North) as Related By Ecological Range Site – Soil Landscape Model Correlations Rule Building, LandWise Inc.

Soil Landscape Models (SLMs) are indicated as soil series unit number/landscape model (e.g. MAB10/U1h). Three-letter soil series codes indicate that one soil series is dominant (e.g., Maleb = MAB). SLMs with four-letter soil series codes indicate two co-dominant soil series that are represented by the first two and the last two letters (e.g., Maleb-Cranford = MACF). Unit numbers range from 1 to 22 (10 in the above example), and represent a particular assemblage of significant soils. The landscape model indicates surface form, relief and slope characteristics. Refer to AGRASID 3.0 for further details (ASIC 2001).

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
————	[Y]Wa 6.0.0	Use for the undifferentiated soil model ZWA only if associated with a water-dominated landscape model (W1, W2, or W3).	Any permanent body of water; (e.g., lakes, reservoirs and rivers).
------	Sb	No occurrences in SCA6 after running rules (for rules see SCA1).	
Complex	[Y]Ri 6.1.5	Use for landscape models of stream channel or floodplain (SC1-l, SC1-h, SC2, SC3, SC4, FP1, FP2, or FP3).	The zone most closely adjacent to stream channels.
FFA01 Rough fescue – Bluebunch fescue – Western Wheatgrass	Ov 6.2.1	For any [X]SLM coded as I3l where the dominant or co-dominant [W]PM does not equal L3 or M4, 50% of the SLM is FFA01 and Ov.	This rule commonly applies to ZUN or ZER soil models. The non-overflow portion is usually assigned to loamy range sites.
------	WL 6.3.1	Use for all SLMs where the 3-letter code equals DWT, IND, or ZGW; **OR** for any 4-letter SLM with DW, IN, ZG, or ZW in the code as either the first two or the last two letters (indicating co-dominance), 50% of the SLM is WL 6.3.1; **OR** use for any 3-letter SLM coded as ZWA if the landscape model is not W1, W2 or W3.	
FFA21 Western Wheatgrass	Cy 6.4.1	Use for all SLMs where the dominant or co-dominant PM equals F0, F1, F2, F3, F4 or L22; **OR** use for all 3-letter SLMs coded as THH or TWG; **OR** use for 4-letter SLMs with TH or TW in the code as either the first two or the last two letters.	Plant Community may be the same as NFA19-Cy (4.4.1) because the limited occurrences in SCA6 are immediately adjacent to SCA4 Cy.
FFA26 Rough fescue – Western Porcupine grass – Green	Lo 6.5.2	Use for all SLMs where the dominant or co-dominant PM equals MO, M2, M3, M4, M6, L3, L10 or L15;**OR** use for any 3-letter SLM coded as ADY, DEL, LTA, or RKV; **OR** use for any 4-letter SLM with AD, DE, LT or RK in the code as either the first two or the last two letters.	

[2]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
Needle grass			
FFA22 Rough fescue – Western Porcupine grass	Sy 6.6.1	Use for all SLMs where the dominant or co-dominant PM equals any of C3, C5, L9, L18, L20 and L21; **OR** use for any 3-letter SLM coded as MDP; **OR** use for any 4-letter SLM with MD in the code as either the first two or the last two letters.	
FFA19 Western wheatgrass – Little Bluestem	Li 6.7.1	Use for all 3-letter SLMs coded as EBO, HIW, HPV, or NSKaa; **OR** for any 4-letter SLM with EB, HI, HP, or NS in the code as either of the first two or the last two letters; **OR** where ZER or ZE do not occur with landscape models I3l, I3h, I4m or I4h; **OR** for the ZUN/I3m SLM.	ZER is associated with the limy range site on I3m or non-inclined landscape models, and also with ZUN/I3m.
FFA25 not characterized	Sa 6.8.1	Each of the following rules applies only to non-duned landscapes. Duned landscape models (D1l, D2l, D1m, D2m, D1h or D2h) belong to CS-FFA25; **For non-duned landscapes:** use for all SLMs where the dominant or co-dominant PM equals C0, C2, C4, or L2; **OR** use for any 3-letter SLM coded as ARE; **OR** use for any 4-letter SLM with AR in the code as either the first two or the last two letters.	Generally LS soil textures.
FFA20 Rough fescue – Western Wheatgrass	BlO 6.9.2	Use for all SLMs where the regional soil choice equals Solonetzic; **OR** for any 3-letter SLM coded as BED or KEO; **OR** for any 4-letter SLM with BE or KE in the code as either of the first two or the last two letters.	Correlates to BED and KEO soil series.
FFA25 not characterized	CS 6.10.1	Each of the following rules applies only to duned landscapes (D1l, D2l, D1m, D2m, D1h or D2h). **For duned landscapes:** use for all SLMs where the dominant or co-dominant PM equals C0, C2, C4, or L2; **OR** use for any 3-letter SLM coded as ARE; **OR** use for any 4-letter SLM with AR in the code as either the first two or the last two letters.	
FFA17 Rough fescue – Parry's Oatgrass – June grass	TB 6.11.1	Use for all SLMs where the dominant or co-dominant PM equals C6, C7, M5, F5, F6, L6, L7, L8, or L16; **OR** use for any soil models with I3h or I4m landscape models.	Very minor area within SCA 6.
FFA09 Rough fescue – Parry's Oatgrass	SwG 6.12.1	Use for all SLMs where the dominant or co-dominant PM equals M1, L4 or L5; **OR** for any 3-letter SLM coded as RSB; **OR** for any 4-letter SLM with RS in the code as either the first two or the last two letters.	Correlates to RSB soil series.
FFA24 not characterized	SL 6.13.2	Use for all 3-letter SLMs coded as BZC, GAY, KYN, or ZNA; **OR** for any 4-letter coded SLMs with BZ, GA, KY, or ZN in the code as either the first two or the last two letters.	Correlates to BZC, GAY, KYN or ZNA soil series.
FFA13	Gr	Use for all SLMs where the dominant or co-dominant PM equals C1, L1, or	Correlates to BOV soil series.

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
Rough fescue – Idaho fescue – June grass	6.14.1	L14; **OR** for any 3-letter SLM with BOV in the code; **OR** for any 4-letter SLM with BO in the code as either the first two or the last two letters.	
------	BdL	No occurrences in SCA6 after running rules (for rules see SCA5).	
----------	[Y]Urb 6.16.1	Use for disturbed land (DL) landscape model.	Cities, towns or disturbed land. The soil model is usually ZUN (undifferentiated).

[Z]Ecological range sites are arranged in order from most productive to least productive to facilitate the identification of the most limiting ecological range site and plant community for co-dominant soil models.
[Y]Indicates an ecological range site that has been added for the purposes of this project.
[X]Soil Landscape Model. [W]Parent material in the master file of AGRASID

Reference Plant Communities of SCA8 (Foothills Parkland Natural Subregion – Thick Black Soils in Southwestern Alberta) as Related By Ecological Range Site – Soil Landscape Model Correlations Rule Building, LandWise Inc.

Soil Landscape Models (SLMs) are indicated as soil series unit number/landscape model (e.g. MAB10/U1h). Three-letter soil series codes indicate that one soil series is dominant (e.g., Maleb = MAB). SLMs with four-letter soil series codes indicate two co-dominant soil series that are represented by the first two and the last two letters (e.g., Maleb-Cranford = MACF). Unit numbers range from 1 to 22 (10 in the above example), and represent a particular assemblage of significant soils. The landscape model indicates surface form, relief and slope characteristics. Refer to AGRASID 3.0 for further details (ASIC 2001).

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
----------	[Y]Wa 8.0.0	Use for the undifferentiated soil model ZWA only if associated with a water-dominated landscape model (W1, W2, or W3).	Any permanent body of water; (e.g., lakes, reservoirs and rivers).
------	Sb	No occurrences in SCA8 after running rules (for rules see SCA1).	
Complex	[Y]Ri 8.1.5	Use for landscape models of stream channel or floodplain (SC1-l, SC1-h, SC2, SC3, SC4, FP1, FP2, or FP3).	The zone most closely adjacent to stream channels.
------	Ov 8.2.1	Use for any [X]SLM coded as I3l where the dominant or co-dominant [W]PM does not equal L3 or M4, 50% of the SLM is Ov; **OR** for all 3-letter SLMs coded as MFT or FSH, 20% of the SLM is Ov; **OR** for all 2-letter SLMs with MF or FS in the code, 10% is Ov.	This rule commonly applies to ZUN or ZER soil models. The non-overflow portion is usually assigned to the Lo- 8.5.1 range site.
See comments	WL 8.3.1	Use for all SLMs where the 3-letter code equals POT or ZGW; **OR** for any 4-letter SLM with PO, ZG, or ZW in the code as either the first two or the last two letters (indicating co-dominance), 50% of the SLM is WL 8.3.1; **OR** use for any 3-letter SLM coded as ZWA if the landscape model is not W1, W2 or W3.	Two plant communities identified by Alberta Public Lands): FPA01 (Sedge, Marsh Reedgrass), and FPA02 (Willow-Bog Birch/Sedge – Tufted Hair Grass). Attempted to separate FPA01 using AVI data, but no polygons correlate to AGRASID.
FPA10 Willow / Rough Fescue – Parry's Oatrgrass	Lo 8.5.1	For any 3-letter SLM coded as MFT or FSH, 80% of the SLM is FPA10-Lo; **OR** for any 4-letter SLM with MF or FS in the code as either the first two or the last two letters, 90% of the SLM is FPA10-Lo.	The 10 or 20% remainder is assigned to Ov-8.2.1. FSH is Clayey (Cy), but only minor ha remain in native cover, so Cy was included with Lo.

[2]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
FPA03 Rough fescue – Parry's Oatgrass	Lo 8.5.2	Use for all 3-letter SLMs coded as BVA, DVG, PPE or SPY; **OR** use for all 4-letter SLMs with BV, DV, PP or SP in the code as either the first two or the last two letters; **OR** use for SLMs coded as HFD or with HF in the code where the landscape model is low relief (U1l, U1h, IUl, IUh, L1, L2, L3, M1m, M3, R2l, H1l, H1m, H5l).	FPA03 unit should be dominantly grasses. AVI was checked for forested tracts mapped as PPE or SPY. However, the AVI splits are not suitable to establish detailed plant communities. Forested tracts should be FPA04 or FPA06.
FPA04 Aspen / Rose / Fireweed	Lo-Asp 8.5.3	Use for azonal montane series in SCA08, including BDYaa, LTCaa, SPRaa, FRKaa, BPEaa, CCRaa, RSNaa, and SCTaa; **OR** use for 4-letter SLMs coded as BDaa, LTaa, SPaa, FRaa, BPaa, CCaa, RSaa or SCaa in the code as either the first two or the last two letters.	Forested plant community. Hardwood (aspen) is mapped as both hardwood and mixed wood in the AVI data, and therefore the AVI splits are not suitable to establish detailed plant communities.
FPA06 Lodgepole Pine / Blueberry / Bunchberry-Pinegrass	Lo-Pi 8.5.3	AVI data was used for the separate field of Pine and overlaid with AGRASID to determine acceptable Lo Soil Landscape Models. Therefore, any Lo polygons within FPA10, FPA03 or FPA04 that coincide with locations of Pine in the AVI data automatically change to FPA06-Lo.	Forested community dominated by Lodgepole Pine. BVA is a common soil series in FPA06, either in combination with DVG, or to a lesser extent with FSH and MFT. Surface soil textures vary from Lo to Sy, with Lo parent material.
FPA11 Rough fescue – Sandgrass	Sy 8.6.1	Use for all 3-letter SLMs coded as CRW, OTP, SHL or SRC; **OR** use for any 4-letter SLM with CR, OT, SH or SR in the code as either of the first two or the last two letters.	FPA11 unit is dominantly graminoid. Lodgepole Pine areas of Sy are classified as FPA06.
To be Determined----------	Li 8.7.1	Use for all 3-letter SLMs coded as GST; **OR** for any 4-letter SLM with GS in the code as either the first two or last two letters; **OR** for the ZUN/I3m SLM; **OR** use where ZER or ZE do not occur with landscape models I3l, I3h, I4m or I4h.	Correlates to GST soil series. ZER is associated with the limy range site on I3m or non-inclined landscape models, and also with ZUN/I3m.
----------	Sa	No occurrences in SCA8 after running rules (for rules see SCA6).	
----------	BlO	No occurrences in SCA8 after running rules (for rules see SCA6).	Includes RDL soil series.
----------	CS	No occurrences in SCA8 after running rules (for rules see SCA6).	
FPA09 Bearberry – Parry's Oatgrass – Rough Fescue	TB 8.11.1	Use for all SLMs with I3h or I4m landscape models; **OR** use for all high-relief landscape models that are combined with SLMs coded as CBD, HFD or OKYaa, or use for all high-relief landscape models that are combined with 4-letter SLMs with CB, HF or OK in the code as either the first two or the last two letters. High-relief landscape models include I3m, M1h, M4, R2m, R2h, H1h, H5m, H5h, HR2h or HR2m.	Correlates to HFD soil series on strong topography.
FPA07	SwG	Use for all SLMs where the dominant or co-dominant PM equals M1, L4 or L5;	

[Z]Plant Community Number	Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
Rough fescue – Parry's Oatgrass	8.12.1	**OR** use for any 3-letter SLM coded as DRW, TBR, or TDC; **OR** use for any 4-letter SLM with DR, TB, or TD in the code as either the first two or the last two letters.	
———	SL	No occurrences in SCA8 after running rules (for rules see SCA4).	
FPA08 Rough fescue – Parry's Oatgrass – Idaho Fescue	Gr 8.14.1	Use for all SLMs where the dominant or co-dominant PM equals C1, L1, or L14; **OR** use for any 3-letter SLM coded as BUR or LNB; **OR** use for any 4-letter SLM with BU or LN as the first two or the last two letters.	------
------	BdL 8.15.1	Use with all SLMs using landscape model I4h or I5.	Minor ha of BdL in SCA8
----------	[Y]Urb 8.16.1	Use for disturbed land (DL) landscape model.	Cities, towns or disturbed land. The soil model is usually ZUN (undifferentiated).

[Z]Ecological range sites are arranged in order from most productive to least productive to facilitate the identification of the most limiting ecological range site and plant community for co-dominant soil models.
[Y]Indicates an ecological range site that has been added for the purposes of this project.
[X]Soil Landscape Model. [W]Parent material in the master file of AGRASID

Range Sites of SCA9 (Aspen Parkland Natural Subregion – Thick Black) as Related By Ecological Range Site – Soil Landscape Model Correlations Rule Building, LandWise Inc.

Soil Landscape Models (SLMs) are indicated as soil series unit number/landscape model (e.g. MAB10/U1h). Three-letter soil series codes indicate that one soil series is dominant (e.g., Maleb = MAB). SLMs with four-letter soil series codes indicate two co-dominant soil series that are represented by the first two and the last two letters (e.g., Maleb-Cranford = MACF). Unit numbers range from 1 to 22 (10 in the above example), and represent a particular assemblage of significant soils. The landscape model indicates surface form, relief and slope characteristics. Refer to AGRASID 3.0 for further details (ASIC 2001).

Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
^{Y}Wa 9.0.0	Use for the undifferentiated soil model ZWA only if associated with a water-dominated landscape model (W1, W2, or W3).	Any permanent body of water; (e.g., lakes, reservoirs and rivers).
Sb	No occurrences in SCA9 after running rules (for rules see SCA1).	Includes ATOaa (home SCA is 10)
^{Y}Ri 9.1.5	Use for landscape models of stream channel or floodplain (SC1-l, SC1-h, SC2, SC3, SC4, FP1, FP2, or FP3).	The zone most closely adjacent to stream channels.
Ov 9.2.1	For any ^{X}SLM coded as I3l where the dominant or co-dominant ^{W}PM does not equal L3 or M4, 50% of the SLM is Ov.	This rule commonly applies to ZUN or ZER soil models. The non-overflow portion is usually assigned to loamy range sites.
WL 9.3.1	Use for all 3-letter SLMs coded as COH, HAR, TUT or ZGW; **OR** for any 4-letter SLM with CO, HA, TU, ZG, or ZW in the code as either the first two or the last two letters (indicating co-dominance), 50% of the SLM is WL 9.3.1; **OR** use for any 3-letter SLM coded as ZWA if the landscape model is not W1, W2 or W3.	Occasional azonal WL soils also occur in SCA9, and these include BZCaa, DEVaa, GSPaa, MLTaa, and RCSaa, . DEVaa represents bogs with sphagnum peat, and GSPaa fens with sedge peat.
Cy 9.4.1	Use for all SLMs where the co-dominant or dominant ^{X}PM equals F0, F1, F2, F3, F4 or L22; **OR** use for any 3-letter SLM coded as BPW, EAT, or LLK; **OR** use for any 4-letter SLM with BP, EA or LL in the code as either the first two or the last two letters.	
Lo 9.5.1	This rule applies only to SLMs located west of Spruce Coulee in the Didsbury – Innisfail – Red Deer corridor. Within that area, use for all 3-letter SLMs coded as ATL, DDY, LPN, or PED, and use for all 4-letter SLMs with AT, DD, LP, or PE in the code as either the first two or the last two letters.	Applies to Thick Black Orthic Chernozemic soils including ATL, DDY, LPN, or PED. The geographic constraint of this rule was largely applied manually.
Lo	Use for all soil landscape models EXCEPT ATL, DDY, LPN and PED in the geographic area	Applies to all loamy soils except Thick

Range Site and Rank	Rules for Using AGRASID Files With the SARS-ALCES Model	Comments
9.5.2	specified for Lo-9.5.1, provided the dominant or co-dominant PM equals MO, M2, M3, M4, M6, L3, L10 or L15; **OR** use for any 3-letter SLM coded as CYG, MKV or NSK; **OR** use for any 4-letter SLM with CY, MK or NS in the code as either the first two or the last two letters.	Black Orthic Chernozems identified in Lo5.1.
Sy 9.6.1	Use for all soil landscape models where the co-dominant or dominant PM equals C3, C5, L9, L20 or L21; **OR** use for any 3-letter SLM coded as HPVaa, RDWaa, TWS or UKTaa; **OR** use for any 2-letter SLM with HP, RD, TW or UK in the code as either the first two or the last two letters.	
Li	No occurrences in SCA9 after running rules (for rules see SCA6).	
Sa 9.8.1	Use only for non-duned landscape models (D1l, D2l, D1m, D2m, D1h or D2h). **For non-duned landscape models:** use for all SLMs where the dominant or co-dominant PM equals C0, C2, C4, or L2; **OR** for any 3-letter SLM coded as MGS; **OR** for any 4-letter SLM with MG in the code as either the first two or the last two letters.	Generally LS soil textures.
BlO 9.9.2	Use for all SLMs where the regional soil choice equals Solonetzic; **OR** use for any 3-letter SLM coded as MYK, NIB or WKNaa; **OR** use for any 4-letter SLM with MY, NI or WK in the code as either of the first two or the last two letters; **OR** use for KVGaa on gentle landscape models (U1l, U1h, IUl, U1l, L1, L2, L3, R2l, H1l, H5l).	KVGaa series on moderate- or high-relief landscape models correlates to TB.
CS 9.10.1	Use only for duned landscape models (D1l, D2l, D1m, D2m, D1h or D2h). **For duned landscape models:** use for all SLMs where the dominant or co-dominant PM equals C0, C2, C4, or L2; **OR** use for any 3-letter SLM coded as MGS; **OR** use for any 2-letter SLM with MG in the code as either the first two or the last two letters.	
TB 9.11.1	Use for all SLMs where the dominant or co-dominant PM equals C6, C7, M5, F5, F6, L6, L7, L8, or L16; **OR** use for any soil models with I3h or I4m landscape models; **OR** use for KVGaa on moderate-to high-relief landscape models (R2m, R2h, M1m, M1h, M3, M4, H1m, H1h, H5m, H5h, HR2m, HR2h).	
SwG, Gr 9.12.5	Use for all SLMs where the dominant or co-dominant PM equals C1, L1, L4, L5, L14, or M1; **OR** use for any 3-letter SLMs coded as SCO, ISF, ATMaa, BOVaa, and FTHaa; **OR** use for any 4-letter SLM with SC, IS, AT, BO and FT in the code as either the first two or the last two letters.	SwG and Gr are combined in a common ecological range site in SCA9.
SL	No occurrences in SCA9 after running rules (for rules see SCA6).	
BdL	No occurrences in SCA9 after running rules (for rules see SCA8).	
[Y]Urb 9.16.1	Use for disturbed land (DL) landscape model.	Cities, towns or disturbed land. The soil model is usually ZUN (undifferentiated).

[Z]Ecological range sites are arranged in order from most productive to least productive to facilitate the identification of the most limiting ecological range site and plant community for co-dominant soil models.

[Y]Indicates an ecological range site that has been added for the purposes of this project.

[X]Soil Landscape Model. [W]Parent material in the master file of AGRASID